Dr.M.H.M.G.N.H. Library
635 HOW
5986

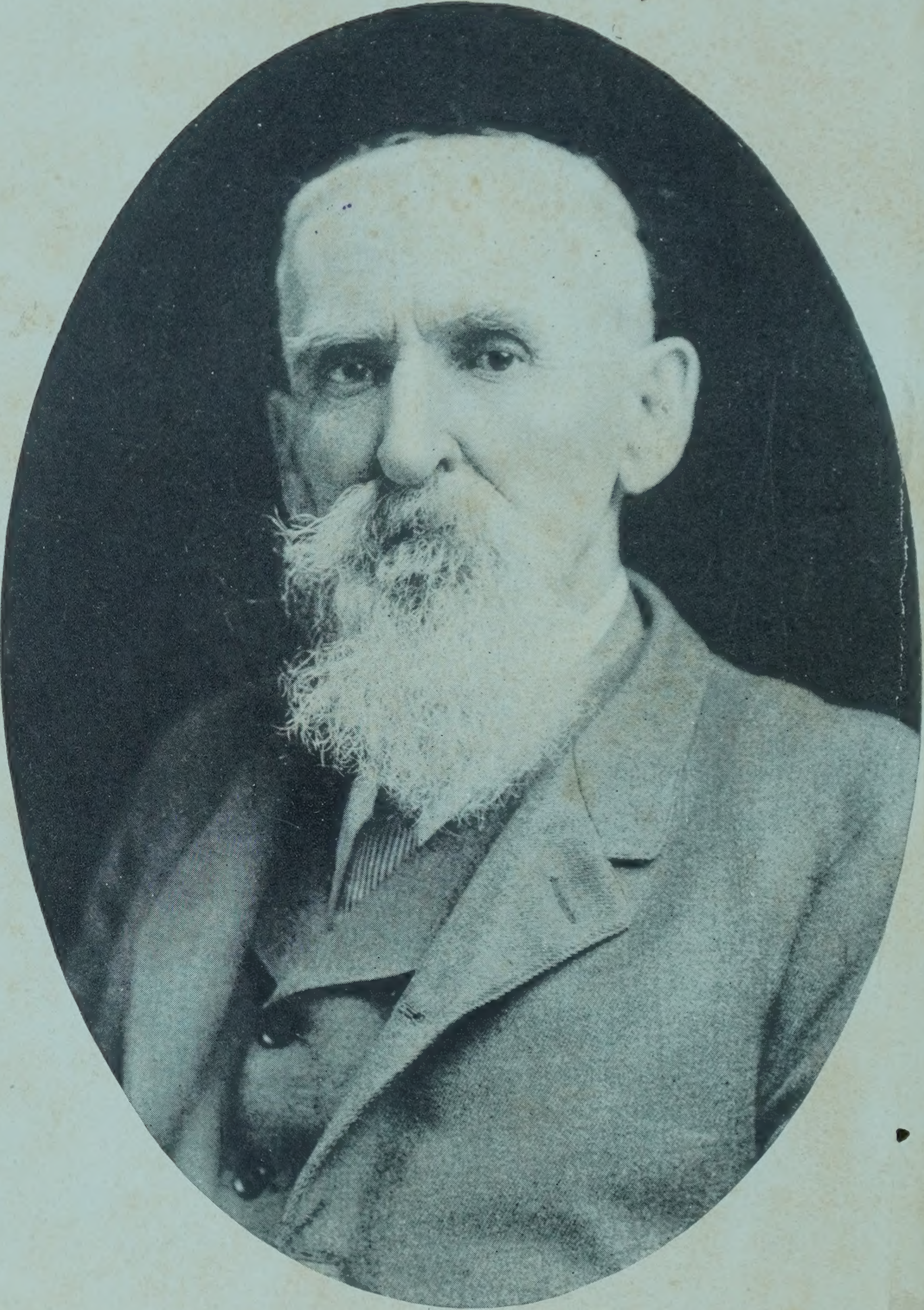
635 HOW

GOVERNMENT BOTANICAL GARDENS
LIBRARY.
Section......................
No..................

Dr.M.H.M.G.N.H. Library
635 HOW
5986

GOVERNMENT BOTANICAL GARDENS
LIBRARY.
Section....................
No...................

Government of Karnataka
Dr. M. H. Marigowda National Horticulture Library
Directorate Of Horticulture Lalbagh,
Bangalore - 560 004
ACC. No. 5986
CALL No. 635 HOW



NICHOLAS FREMONT MURRAY.

(See pages 95 and 248.)

SECOND ANNUAL REPORT

OF THE

MISSOURI

State Board of Horticulture

GOVERNMENT BOTANICAL GARDENS
LIBRARY.
Section,....................
No....................

CONTAINING THE PROCEEDINGS OF THE

Summer Institute Held at Mountain Grove, June 2, 3, 4, 1908, and of the Winter Institute Held in Columbia, January 5, 6, 7, 8, 1909, in Connection With “Farmers’ Week.”

W. L. HOWARD, Secretary,
Columbia, Mo.

THE HUGH STEPHENS PRINTING COMPANY,
JEFFERSON CITY, MO.

638.06
Aow

Missouri State Board of Horticulture

(Created by Act of the Legislature, March 12, 1907.)

OFFICERS OF THE BOARD, 1908.

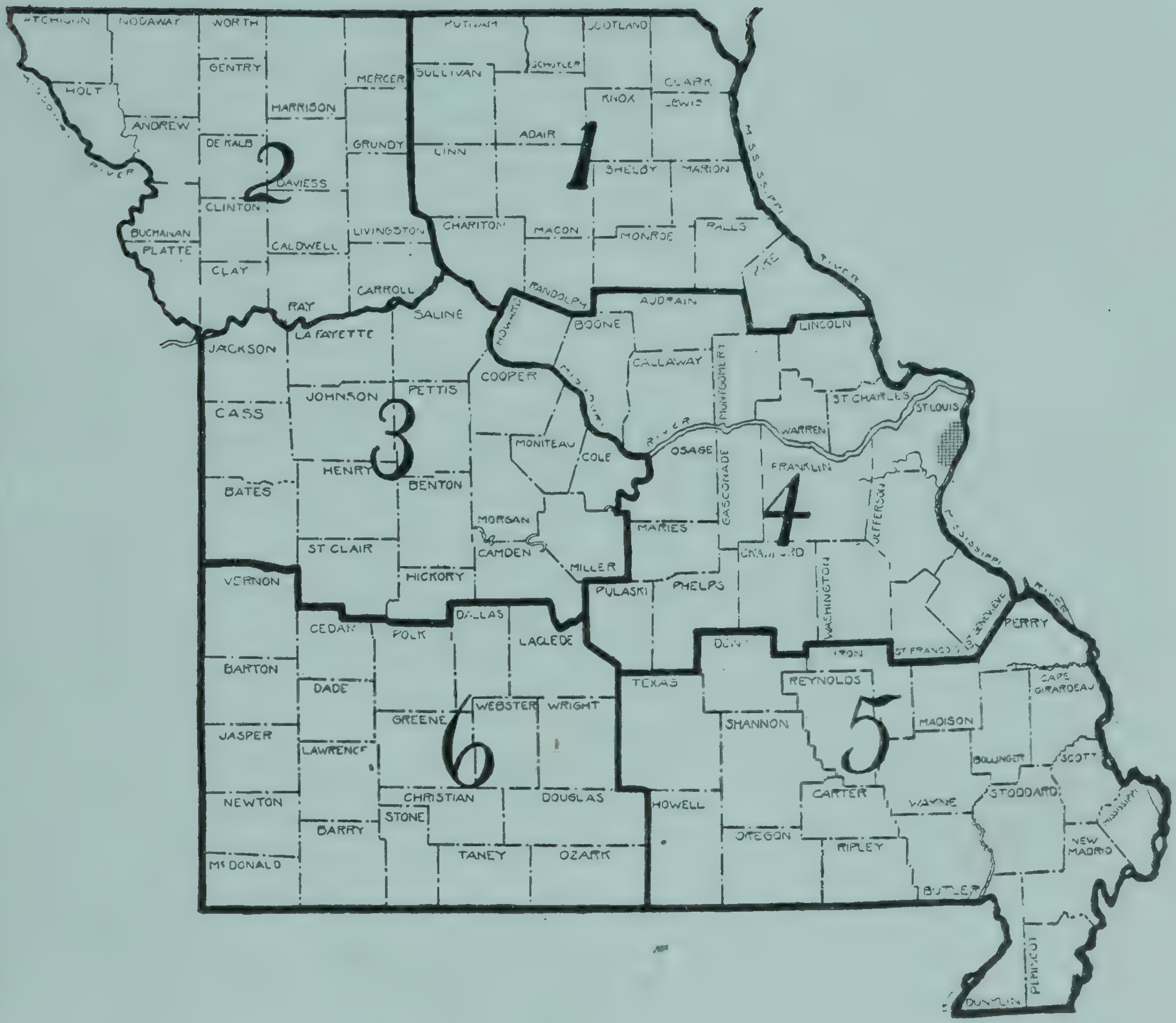
W. P. STARK, President	Louisiana
R. M. HITT, 1st Vice-President	Koshkonong
J. H. CHRISTIAN, 2nd Vice-President	Neosho
T. H. TODD, Treasurer	New Franklin
W. L. HOWARD, Secretary	Columbia
W. L. DRIVER, Assistant Secretary	Columbia

EXECUTIVE COMMITTEE.

FIRST DISTRICT, W. P. STARK (Term expires June, 1911.)	Louisiana
SECOND DISTRICT, N. F. MURRAY (Died May 26, 1908.)	Oregon
L. C. WILSON, (Appointed June, 1908) (Term expires, June, 1909.)	South St. Joseph
THIRD DISTRICT, C. H. DUTCHER (Term expires June, 1911.)	Warrensburg
FOURTH DISTRICT, T. H. TODD (Term expires June, 1909.)	New Franklin
FIFTH DISTRICT, R. M. HITT (Term expires June, 1911.)	Koshkonong
SIXTH DISTRICT, J. H. CHRISTIAN (Term expires June, 1909.)	Neosho

EX-OFFICIO MEMBERS.

HON. HERBERT S. HADLEY	Governor of Missouri
DR. J. C. WHITTEN, Professor of Horticulture	University of Missouri
PROFESSOR H. A. GASS,	State Superintendent of Schools


ATCHISON
NODAWAY
WORTH
PUTNAM
SCOTLAND
SCHUYLER
GENTRY
MERCER
SULLIVAN
CLARK
HOLT
KNOX
LEWIS
HARRISON
ANDREW
ADAIR
DE KALB
GRUNDY
LINN
1
SHELBY
MARION
MISSISSIPPI
2
DAVIESS
CLINTON
MISSOURI RIVER
BUCHANAN
PLATTE
LIVINGSTON
CHARITON
MACON
MONROE
RALLS
CALDWELL
CLAY
PIKE
RIVER
CARROLL
RAY
RANDOLPH
AUDRAIN
SALINE
HOWARD
BOONE
LINCOLN
LA FAYETTE
JACKSON
CALLAWAY
MONTGOMERY
COOPER
JOHNSON
PETTIS
ST CHARLES
ST LOUIS
CASS
MISSOURI
RIVER
WARREN
3
MONITEAU
OSAGE
COLE
GASCONADE
FRANKLIN
HENRY
BENTON
BATES
4
JEFFERSON
MORGAN
MARIES
MISSISSIPPI
ST CLAIR
CAMDEN
CRAWFORD
MILLER
WASHINGTON
HICKORY
VERNON
PULASKI
PHELPS
STE GENEVIEVE
RIVER
DALLAS
PERRY
CEDAR
POLK
LACLEDE
DENT
IRON
ST FRANCOIS
BARTON
TEXAS
REYNOLDS
CAPE GIRARDEAU
DADE
WEBSTER
WRIGHT
SHANNON
5
MADISON
GREENE
6
JASPER
LAWRENCE
BOLLINGER
SCOTT
CARTER
STODDARD
CHRISTIAN
DOUGLAS
HOWELL
WAYNE
MISSISSIPPI
NEWTON
STONE
BARRY
OREGON
RIPLEY
NEW MADRID
TANEY
OZARK
McDONALD
BUTLER
PEMISCOT
DUNKLIN

Map showing the counties included in each of the six Horticultural Districts of Missouri. For name and address of each member of the Board from the different Districts, see next page.

LETTER OF TRANSMITTAL.

To the Hon. Herbert S. Hadley, Governor of Missouri:

Sir—In compliance with the law, I have the honor to transmit herewith a report of the work of the State Board of Horticulture for the year 1908.

Very respectfully,

W. L. HOWARD,
Secretary.

CONTENTS.

Report of the Secretary: Page

The Year's Work 4
Financial 13
Nursery and Orchard Inspection 18
Report of Treasurer 21
Summer Institute 24
Program 24
Welcome address by Mayor Candler 26
Address of Welcome by Frank Horsfall 27
Response by President Dutcher 27
Influence of Music in the Home 31
New Varieties of Strawberries 33
Report on Crop Conditions 38
How to Reach the Unsupplied Markets 38
Cross Pollination 43
Growing Tomatoes for Canning Purposes 48
Apple Day at the State Fair 53
The Necessity for Spraying 53
Selection of Peach Buds for Budding 56
Peach Growing 59
Orchard Fungus Diseases 63
Recent Work Against San Jose Scale in Missouri 70
Hardy Peaches 77
Large vs. Small Orchards 82
Best Commercial Varieties of Strawberries 87
How Can Farmers be Influenced to Beautify Their Homes 88
Ups and Downs of Apple Growing 90
Some of the Most Desirable Shrubs, Climbers and Plants for Decorating the Home Grounds 93
Report of Committee on Awards 95
Report of Committee on Obituary 95
Report of Committee on Final Resolutions 96
Winter Institute 97
Program 97
Premium List 101
Styles of Pruning Practiced in the Northwest 103
A Visit to the Georgia Peach District 108
Hardiness of Peach Buds, Blossoms and Young Fruit, as Influenced by the Care of the Orchard 113
New, versus Old Methods of Packing and Marketing Apples 132
Horticultural Development for Missouri 145
Arbor Day.—Its Significance and Observance 149
The Relation of Early Maturity to Hardiness in Trees 152
Missouri's Opportunities in Foresty 156
Methods, Conditions and Future Prospects of the Fruit Districts of the West, Compared with Missouri and Sister States 163
Why We Prune 174
How to Grow and Care for Grapes 179
How the Fruit Grower Deals with the Insect Problem in Colorado 185
How the Insect Situation Has Been Handled in Illinois 192
The Leading Insect Problems of the Year 197
How to Can Fruits and Vegetables on the Farm 202
Intensive Farming 215
Orchard Cover Crops 215

Winter Institute—Continued—

Page
The Strawberry as Grown Commercially in the West 222
Growing Cantaloupes in Colorado as seen by a Missourian 232
Impressions of the Orchards and Orchard Districts of the West 235
Some Thoughts on Plant Breeding 239
Visiting Representatives 243
Premiums Awarded 245
Nicholas Fremont Murray, (Obituary) 248
Wayne County Horticultural Society 249

Miscellaneous Papers:

Missouri Apple Growing 254
Hotbeds and Cold Frames, Preparation and Management 266
Missouri's Timber Supply 275
A Disease of Neglected Peach Trees 278
The Development of Disease—Resistant Plants 283
Missouri Horticulture 296
Grape Growing 300
Fundamental Principles of Pruning 302
Instructions for Spraying 314

REPORT OF SECRETARY.

To the President and Members of Missouri State Board of Horticulture:

Gentlemen—I have the honor to present to you a review of what has been accomplished during the past year, together with suggestions for future work to be undertaken by this office, and would recommend that said review and suggestions be published in the forthcoming annual report.

The Fruit Situation—The record of the past year will constitute a dark page in the horticultural history of the State on account of the general failure of the fruit crop. This failure was due to a freeze of unprecedented severity during the first week in May. In a few sections considerable fruit was harvested and marketed to good advantage, but, generally speaking, the apple crop was confined to a limited section of the northwestern part of the State and the peach crop to a few of the southern counties, while strawberries and other small fruits which were able to put forth new flowers after the freeze, were to be found with light yields scattered over all the counties where they are planted. There was also a sprinkling of pears in the apple section.

WORK ACCOMPLISHED DURING 1908.

At the outset, it should be stated that the present Secretary did not assume the duties of his office until the first Tuesday in June, as provided by the constitution and by-laws, and although the Summer Institute was begun on that date and continued for two days afterward, the program was planned and the sessions conducted by last year's officials, so that all the credit for the success of the Mountain Grove Institute belongs to them.

Immediately after the summer meeting the headquarters were established at Columbia. The University authorities fitted up a spacious room in the horticultural building for the Secretary's office. Work was begun under a serious handicap, as the office possessed no mailing list through which to get into touch with the fruit growers. Indeed, the office was opened without owning even a postage stamp or lead pencil in the way of equipment. The Board having authorized the purchase of some emergency supplies and the employment of an assistant who was to be a stenographer, active work was begun immediately. The task taken up first was the collection of names and addresses of fruit growers. The basis for this work was the membership lists of the county associations as published in the last annual report. It was soon found that the larger portion of these associations were no longer active, and since about one-fourth of them did not make any response at all to our requests for the names and addresses of their members we must conclude that the organizations as such are no longer in existence. After a correspondence covering over four months, during which time many hundreds of letters were written, a list of 3,028 names and addresses of fruit growers in Missouri was obtained, and the whole arranged in card index form and carefully classified by counties. In addition to the Missouri mailing register, it was thought desirable to work up a live exchange list, and after considerable correspondence we succeeded in securing the names of over a hundred organizations, etc., all of which were willing to send us their literature in return for our annual reports. These exchanges consist of the various state horticultural organizations throughout the United States, publishers of horticultural periodicals, the State Experiment Stations, and the different divisions of the Agricultural Department at Washington. The literature thus received will be of much use to the office and will enable us to place our reports in libraries and before the people through the medium of the periodicals, which will make use of the matter contained in them, and finally enable us to have definite channels through which we can give our meetings and any other work we may undertake the widest possible publicity.

By means of the list of Missouri fruit growers which we now have, we hope in the near future to undertake an orchard survey, which will show the extent of the commercial orchards of the State, together with many details, such as the number of acres of each variety, and later still, collect accurate statistics as to crop conditions throughout the season and the final yield at harvest time. In short, we hope by means of a live mailing list to keep in such close touch with the fruit growers that we will at all times have a secure grasp on the fruit situation.

For some time there has been a general awakening on the part of fruit growers and horticultural writers in favor of smaller orchards and better management. For many years past, Missouri has received a large amount of advertising as a desirable fruit state. This campaign of publicity in favor of Missouri fruit growing might be said to have had its climax in the mammoth fruit exhibit shown at the St. Louis World's Fair in 1904. Following the exposition there was a great influx of land buyers who wished to engage in fruit growing. Many of these people had no knowledge of how to handle an orchard. In too many instances the orchards planted were far too large to be given the proper attention. Calls for advice and assistance became so great on the part of the orchard owners that it was determined to institute a campaign, and a determined one, having for its watchwords, smaller orchards and better management. In order to be able to give Missouri fruit growers the very best information to be had, the Board decided to send special delegates to as many of the leading fruit districts of the United States as possible. A peach grower of long experience and acknowledged ability was sent to Georgia at the proper season to collect information pertaining to the peach industry. A practical apple grower, whose judgment is often sought, because of his unusual success in growing that fruit, was sent to the famous fruit districts of Washington, Oregon, Montana, Idaho and other well-known centers in the West and Northwest to study orcharding in all of its phases. This delegate made a personal inspection of methods of cultivation, pruning, spraying, as well as the picking and packing of the fruit. Typical points were selected for these studies, where all the different phases of orcharding have been improved to the highest degree to be found anywhere in the United States. A man who has been identified with the growing of small fruits since the beginning of that industry in what is now the most famous strawberry growing district in the State was selected to visit some of the highly developed berry regions of the West to gather information. And finally, in order that as many lines of horticulture as possible might be improved at once, a man who is familiar with the growing of melons, particularly cantaloupes, was delegated to visit Colorado and learn all he could pertaining to melon growing. It was believed that this was the best possible manner in which to secure usable information on orcharding and gardening since all of the delegates sent out to collect information were practical workers in horticulture, and, having the same view points as other horticulturists throughout the State, would be able to describe in language common to all and virtually make all hearing the talks see through their eyes what they had seen in the various places and thus be the means of contributing information, the value of which will be incalulable. Good information can be, and often is, supplied by means of literature or through visitors brought from other regions especially to tell us about their work, but in both cases the view points of these writers or speakers are often different from our own, and consequently we do not appreciate their advice with such fullness as when we have procured it upon the ground ourselves. However, since it is not possible for very many of our fruit growers to visit fruit regions in other states, it is clearly the duty of the State to get all the useful information possible from these places, and the next best thing to having the growers go in person was to send special representatives from their number who would be able to collect and disseminate all the information desired.

The reports of the delegates sent to the various places to collect practical horticultural information were presented in open meeting at the different sessions of the Winter Institute, and ample opportunity was given for visitors to ask as many questions as they desired. These reports will also be published in our annual report, and we hope, in addition, to have reprints of some of them made in pamphlet form for the purpose of giving this special information the widest possible distribution.

Secretary's Office—The wisdom of establishing the headquarters at Columbia, in connection with the Department of Horticulture of the Agricultural College, has been amply justified by the results already obtained. The Agricultural College, the Experiment Station, and the State Board of Agriculture, now working hand in hand at Columbia, are all highly organized working bodies which have for their aim the betterment of agriculture in general. With our headquarters located elsewhere in the State, it would have been inevitable, even in our own special field, that we should have tried to cover some of the ground now being covered. As it is, this office has been able to co-operate in many matters of considerable importance not only with the State Board of Agriculture, but also with the College and the Station, and thus we have prevented much duplication of effort. Only recently the Dean of the College of Agriculture has cordially invited us to co-operate with the College in doing some educational work among the rural schools of the State. Our part of this enterprise will consist in gathering and disseminating lessons pertaining to horticulture in particular, The value of such co-operation is found in the fact that our efforts would become a part of an organized plan of rural education.

Assurances have been received from the authorities that we may have free use of all the equipment and facilities in the possession of the College and Station at any and all times, provided only that our use of College or Station property be so arranged as not to interfere with their work. The importance of this offer is realized when it is seen that it places at our disposal the use of the libraries, experimental records, greenhouses, orchards, and apparatus and equipment of various sort.

During the past year members of the Board have visited meetings held by local horticultural associations and participated in the proceedings, and two meetings outside the State have been attended. For lack of funds we were not represented at any of the State meetings of the surrounding states.

The Board has always shown an inclination at every opportunity to serve the interests of the fruit growers of the State by doing everything within its power to correct the existing abuses in the way of unjust rates on fruit shipments. Following up its victory of the year before in securing a reduction of 25 to 40 per cent on freight rates within the State, the Board, at its business session held at Mountain Grove in June, appropriated $100.00 to assist the Ozark Fruit Growers' Association and other shippers' organizations in carrying the matter of better and more just rates on fruit before the Interstate Commerce Commission for the purpose of adjusting unjust rates on interstate shipments. So far as we are informed, this cause is still pending.

The Board loyally supported the Secretary in his efforts to make the Winter Institute at Columbia a notable meeting. The program presented was a strong one. While the subjects discussed covered a considerable range of horticultural topics, especial attention was given to up-to-date methods of orchard management and fruit packing. An instructive feature of the meeting was an exercise in packing, conducted by a man who has had many years' experience in handling fruit put up by the latest improved methods; that is, in boxes with each individual fruit wrapped in paper.

Fruit Exhibit—In connection with the Winter Institute, special efforts were made to have a creditable fruit exhibit. Our aim was to have not only displays of all of the common and many of the newer varieties grown in the State, but to have in addition a goodly quantity of fruit from the famous fruit districts of the West and Northwest by which we expected to teach our people some valuable lessons. The foreign fruit thus contributed was not entered for prizes, but through the liberality of the growers it was placed upon our tables merely to show what they produce. The plan of publishing a premium list was adopted, and it is hoped that in the future this will be a feature of each regular institute. Hereafter the premium lists will be prepared well in advance and distributed among the growers in order that they may have a better understanding of what is desired in the way of exhibit material. In the future it is planned to have the exhibits cover a wide range of horticultural products, including not only fruits of all kinds, but flowers and vegetables as well.

Local Organizations—A plan is being worked out by means of which it is hoped to co-operate more systematically with local societies than has heretofore been possible. It is realized that the people at large can be more effectually reached through local organizations of their own than through our State meetings.

Farmers' Week—This year, for the first time, we co-operated with the State Board of Agriculture by holding our Winter Institute at Columbia during Farmers' Week, thus giving the fruit growers an opportunity for meeting hundreds of farmers who are interested in other phases of agriculture, and not only forming many pleasant acquaintances, but also attending the sessions and hearing some of the talks on subjects which are of very great interest to fruit growers. For example, during some of the sessions of the Missouri Corn Growers' Association, such subjects as "Corn Improvement" and "Soils" were treated by men of national reputation. And these topics proved to be as interesting to our visitors as were the technical horticultural subjects.

During the course of our meetings it was found possible to give some demonstration work in practical pruning, spraying and propagation. These exercises were conducted by members of the horticultural faculty of the University, and it is believed they were of value to the visitors. The pruning and spraying demonstrations were carried on in the orchards belonging to the horticultural department of the Agricultural College.

PROPOSED NEW WORK FOR THE NEXT TWO YEARS.

Horticulture in the Rural Schools—During the next two years this office hopes to be able to take up some new lines of work in addition to the regular lines now being carried on. In the first place it is desired to co-operate with the Agricultural College in conducting some educational work in the rural schools of the State. With this end in view we have asked the county commissioners of the various counties to send us lists of teachers within their jurisdiction who are interested in teaching agriculture and horticulture in their schools, and who would be willing to make use of some simple horticultural lessons if we were to send them to them. Already we have had responses showing that 4,956 teachers, representing 54,516 pupils, are anxious to avail themselves of our proposed assistance.

If we are enabled to carry out this plan, the possibilities and effects on horticulture in the future can hardly be estimated. By reaching the sons and daughters of farmers during the formative years of early childhood, we have every right to hope and expect that they will be influenced to adopt better methods in their farm operations and at the same time learn many useful facts relating to the principles of agriculture and horticulture. By influencing the children to read and study agricultural literature, it would be but a step farther to give them systematic instruction by mail on topics covering all the activities of farm life. Of course, the Board of Horticulture could not carry out all of this work to its logical conclusion, but by co-operating with the Agricultural College, that institution could and would take up the more difficult parts of this instruction after it had passed beyond our powers and facilities to handle. We would thus be the means of starting and fostering a great educational wave which in time would sweep over our State and in its wake would be borne a new horticulture and a new agriculture which would redound to the credit of our organization.

In order to undertake this educational work, it will be necessary for the Legislature to give us, in addition to our regular funds, a special item of at least one thousand dollars for printing and distributing the lessons during the next two years. As a corollary to this it will be necessary to have the fund for printing our annual report doubled in order that we may publish just twice the number of reports we are now issuing so that we can place a copy in the library of each school where lessons are being sent. Furthermore, the law should be changed which requires that one-half of the reports shall be bound in paper, in order that the entire number may be bound in boards. The item for printing would then, for the two years, amount to about five thousand dollars. With one-half of the reports bound in paper the total amount for printing during the last two years was two thousand dollars, but this sum was insufficient. In fact, there has been an annual deficiency in the printing fund for the last eight years. In connection with the proposed educational work, it is expected that we would be able to institute a system of school gardening. We would merely inspire this work, however, and the teachers and patrons of the schools could be trusted to keep it going. Gardening contests, both at home and at school, could be stimulated by prizes offered by local business men and other interested parties. Fruit shows could also be held and exhibits of fruits made by the school children at local fairs, farmers' institutes and horticultural meetings, at which prizes could be offered by local individuals, and interests, supplemented by prizes of fruit trees, etc., which could be offered by nurserymen and dealers in horticultural goods, even though these latter parties might have their places of business considerably removed from the places where the local shows were held. It would be a simple matter to get the large quantities of fruit so exhibited sent to the semi-annual institutes held by the Board of Horticulture, where again cash prizes offered by the Board could be supplemented by special premiums given by nurserymen, seed dealers, fertilizer companies, manufacturers of spraying machinery, spraying materials and implements and supplies of all kinds.

Experimental and Testing Work—From time to time various appliances, nostrums, remedies and formulae for treating trees and plants that have been injured or may be injured by animals, insects, diseases, etc., appear upon the market and are sold to our fruit growers. Some of these patented and unpatented things possess some merit, but in many instances they are frauds pure and simple, and it seems to fall within the province of this Board to undertake to test some of these things offered for sale and thus guard the interests of fruit growers who have no time for making the investigations themselves. The experiment stations are always burdened with experiments of all kinds, and in very many instances it is impossible for them to undertake to make miscellaneous tests of various sorts without waiting for considerable periods until the things they already have under consideration are out of the way. With the facilities that would be placed at the disposal of this office by the Experiment Station, many things could be tested and records kept of the results at very slight expense. By being in close touch with the Experiment Station, it could be decided by conference and mutual agreement just what tests should be undertaken by the station and what should be handled by this office.

Variety Tests—A system of fruit testing might also be inaugurated by this office. Parties having new varieties which they desire to have tested could send them here and from this office be distributed to practical growers throughout the six districts of the State, where they could be planted by parties designated by the Board members from those districts. The Secretary could keep a record of all trees distributed and collect a report on their behavior each year. In this way any given variety of fruit might be systematically and generally tested throughout the entire State and the results would be official. It is estimated that $100.00 to $200.00 would be sufficient to carry on this work for two years.

A Missouri Fruit Show—At an early date it is hoped that arrangements can be made for holding a fruit show of national importance somewhere in Missouri. Our western neighbors have lately been showing the world what they can do in the fruit line, and Missouri could receive no better advertising at this time than for the growers to get together such a collection of fruit as we know this State can produce. Other states would, of course, be invited to send displays, but there is no need to fear but what we could hold our own in the contest, provided the season were a normal one. If possible, the show should not be held unless our apple crop were a good one, a point which could be determined with reasonable certainty as early as May of any year.

Office Furniture—Starting out with no equipment at all last June, the Board has supplied this office with a few articles of furniture which were absolutely necessary. We now own one typewriter, one desk, one letter filing cabnet, one six-drawer card index cabinet and nineteen linear feet, four units high, of sectional book cases. Also, if the proposed educational work is attempted, it is imperative that we purchase a multigraph, and even though the school work were not attempted, this machine would be an economical means of doing much of our printing. The furniture needed will cost two hundred and fifty dollars and the multigraph three hundred.

Library—In order to carry on the work of this office, we should have a few books to serve as a working library. One hundred dollars would be sufficient for the next two years. The needs for funds for carrying on the regular summer and winter institutes for salaries and general office expenses, as well as traveling expenses of the Board in attending business meetings, are not mentioned here, for the reason that they are well known to you and do not need recounting.

Respectfully submitted,

W. L. HOWARD, Secretary.

SECRETARY'S FINANCIAL REPORT.

To the State Board of Horticulture:

Gentlemen—I beg leave to submit the following exhibit of the financial transactions of the Board of Horticulture for the period beginning January 1, 1908, and ending June 1, 1908, which shows the balance on hand at the beginning of the period, the vouchers drawn on the Treasurer of the Board, and the balance in the treasury of the Board:

1907.				
Dec.	31	To balance on hand		$1,102 86
July	3	To requisition on State Auditor		1,500 00
		Total		$2,602 86
1908.				
Jan.	24	To voucher No. 17		$31 40
		C. H. Dutcher, expenses to Van Buren to Arkansas State Meeting	$24 30	
		T. H. Todd, expense to Mexico	7 10	
		Total	$31 40	
Jan.	31	To voucher No. 18		$120 00
		G. T. Tippin, salary	$100 00	
		Postage	3 60	
		Office supplies	1 35	
		Express	1 65	
		Cuts for report	5 40	
		Office rent for February	8 00	
		Total	$120 00	
Feb.	29	To voucher No. 19		$112 43
		G. T. Tippin, salary	$100 00	
		Postage	3 20	
		Express	98	
		Office supplies	25	
		Office rent for March	8 00	
		Total	$112 43	
Mar.	31	To voucher No. 20		$112 00
		Postage	$2 50	
		Express	1 50	
		Office rent for April	8 00	
		G. T. Tippin, salary	100 00	
		Total	$112 00	
April	6	To voucher No. 21		$17 30
		G. T. Tippin, expense to Jefferson City Annual Report, index and mailing	$17 30	
		Total	$17 30	
April	11	To voucher No. 22		$11 50
		G. T. Tippin, postage	$10 00	
		Printing	1 50	
		Total	$11 50	
April	21	To voucher No. 23		$21 50
		Printing	$15 00	
		G. T. Tippin, postage	6 50	
		Total	$21 50	

April	30	To voucher No. 24		$130 00
		G. T. Tippin, salary	$100 00	
		Postage	12 50	
		Office rent	8 00	
		R. R. fare to Kansas City, return, meals	9 50	
		Total	$130 00	
April	30	To voucher No. 25		$50 00
		T. H. Todd, salary for year as treasurer	50 00	
June	2	To voucher No. 26		$32 05
		T. H. Todd, expenses, Saverton, Cooper Co. and Chariton Co.	$13 40	
		C. H. Dutcher, expenses to Jefferson City, Missouri Valley Society meeting, postage, envelopes	14 15	
		C. R. Jackson, Carrollton meeting	4 50	
		Total	$32 05	
June	2	To voucher No. 27		$140 50
		G. T. Tippin, salary for May	$100 00	
		Postage	3 10	
		Express	35	
		Typewriter, rent for one year	36 00	
		Balance, exp. account to Jefferson City from voucher No. 15.	1 05	
		Total	$140 50	
June	2	To voucher No. 28		$11 35
		C. H. Dutcher, expense Carrollton meeting	$11 35	
		Total	$11 35	
June	2	To voucher No. 29		$13 10
		T. H. Todd, expense Carrollton meeting	$13 10	
		Total	$13 10	
June	3	To voucher No. 30		$80 22
		W. L. Driver, expense Mountain Grove meeting	$23 04	
		J. C. Whitten, expense Mountain Grove meeting	26 04	
		C. H. Dotcher, expense Mountain Grove meeting	12 44	
		L. C. Wilson, expense Mountain Grove meeting	18 70	
		Total	$80 22	
June	3	To voucher No. 31		$49 93
		W. P Stark, expense Mountain Grove meeting	$26 96	
		H. A. Gass, expense Mountain Grove meeting	16 92	
		R. M. Hitt, expense Mountain Grove meeting	2 50	
		G.T. Tippin, expense Mountain Grove meeting	2 85	
		Incidentals	70	
		Total	$49 93	
June	3	To voucher No. 32		$524 54
		Hugh Stephens Printing Co., wrapping and mailing reports.	$398 68	
		Interstate Commerce Commission, expense	100 00	
		T. H. Todd, expense Mountain Grove meeting	25 86	
		Total	$524 54	
June	4	To voucher No. 33		$90 79
		H. M. Dunlap, expense Mountain Grove meeting	$26 04	
		Mrs. E. H. Hodge, expense Mountain Grove meeting	6 25	
		Hotel bill, expense Mountain Grove meeting	48 00	
		Premiums, expense Mountain Grove meeting	10 50	
		Total	$90 79	
		Grand total to vouchers		$1,548 61
		To balance in hands of treasurer		1,054 25

Respectfully submitted,

G. T. TIPPIN, Secretary.

SECRETARY'S FINANCIAL REPORT.

To the State Board of Horticulture:

Gentlemen—I beg leave to submit the following exhibit of the financial transactions of the Board of Horticulture for the period beginning June 2, 1908, and ending January 15, 1909, which shows the balance on hand at the beginning of the period, vouchers drawn on the Treasurer of the Board, requisitions drawn on the State Auditor, and the balance in the treasury of the Board:

1908.			
June 2	To balance on hand		$1,054 25
Sept. 23	To requisition on State Auditor		1,500 00
	Total		$2,554 25
July 1	To voucher No. 34		$227 62
	Pacific Express Co	$4 60	
	American Express Co	2 55	
	Co-operative store, office supplies	30 45	
	Stephens Publishing Co., printing, stationery	41 75	
	R. P. Scurlock, freight and drayage	6 22	
	Postage	10 00	
	Telegrams	1 05	
	Postage for July	31 00	
	Salary, W. L. Howard	50 00	
	Salary, W. L. Driver	50 00	
	Total	$227 62	
July 20	To voucher No. 35		$270 34
	Pacific Express Co	$5 74	
	American Express Co	1 65	
	Fox Typewriter Co., machine	72 00	
	Columbia Typewriter Co., machine cover	50	
	Parker Furniture Co., desk and filing cabinet	56 00	
	Meilink Mfg. Co., typewriter desk	4 00	
	R. L. Tomlinson, chair cushion	2 00	
	National Paper Co	10 20	
	W. E. Harshe, receipt books	25	
	Co-operative store, supplies	2 85	
	E. W. Stephens Publishing Co	4 25	
	John W. Evvard, printing	90	
	Postage for August	10 00	
	Salary, W. L. Howard	50 00	
	Salary, W. L. Driver	50 00	
	Total	$270 34	
August 20	To voucher No. 36		$128 08
	American Express Co	$ 80	
	National Paper Co., paper	10 88	
	Freight on same	80	
	R. P. Scurlock, drayage	60	
	Salary, W. L. Howard	50 00	
	Salary, W. L. Driver	50 00	
	Postage for September	15 00	
	Total	$128 08	
August 31	To voucher No. 37		$127 08
	R. M. Hitt, expenses trip to Georgia	$113 53	
	R. M. Hitt, expenses trip to Campbell, Mo	13 55	
	Total	$127 08	

Sept.	21	To voucher No. 38		$108 70
		Pacific Express Co., August and September	$3 70	
		Postage for October	5 00	
		Salary, W. L. Howard	50 00	
		Salary, W. L. Driver	50 00	
		Total	$108 70	
Oct	13	To voucher No. 39		$16 20
		R. M. Hitt, expenses trip to Wayne county Horticultural meeting, Wappapello, Mo	$16 20	
		Total	$16 20	
Oct.	16	To voucher No. 40		$65 60
		L. C. Wilson, expense strip to Colorado, railroad fare	$39 60	
		Hotel bills	22 75	
		Circular letter and postage	3 25	
		Total	$65 60	
Oct.	21	To voucher No. 41		$157 62
		American Express Co	$3 35	
		Pacific Express Co	5 47	
		Fox Typewriter Co., ribbons and carbon	8 63	
		Co-operative store, supplies	9 30	
		E. W. Stephens Publishing Co	8 50	
		R. L. Tomlinson, repairs on furniture	1 25	
		R. P. Scurlock, freight and drayage	62	
		Postage for November	20 00	
		Salary, W. L. Howard	50 00	
		Salary, W. L. Driver	50 00	
		To overcharge, E. W. Stephens Publishing Co	50	
		Total	$157 62	
Oct.	26	To voucher No. 42		$13 25
		C. H. Dutcher, expenses meetings at—		
		Swope's park	$3 60	
		Rosedale, Kansas	3 30	
		Edwardsville, Kansas	3 70	
		Postage for year	2 65	
		Total	$13 25	
Oct.	11	To voucher No. 43		$284 20
		T. H. Todd, expense account visit to Western orchards	$284 20	
		Total	$284 20	
Nov.	20	To voucher No. 44		$334 88
		Pacific Express Co	$10 51	
		American Express Co	10 07	
		R. P. Scurlock, freight and drayage	1 00	
		Parker Furniture Co	140 75	
		Chas. Matthews	1 50	
		C. W. Furtney, supplies	1 20	
		Columbia Printing Co	32 85	
		Postage for December	37 00	
		Salary, W. L. Howard	50 00	
		Salary, W. L. Driver	50 00	
		Total	$334 88	
Nov.	20	To voucher No. 45		$145 10
		J. H. Christian, expense Western trip to strawberry centers	$145 10	
		Total	$145 10	
Dec.	1	To voucher No. 46		$7 33
		T. H. Todd, expenses board meeting at Columbia	$7 33	
		Total	$7 33	

Dec.	1	To voucher No. 47		$45 18
		Expenses board meeting of—		
		C. H. Dutcher	$12 16	
		L. C. Wilson	14 52	
		W. P. Stark	4 00	
		Hotel Gordon	14 50	
		Total	$45 18	
Dec.	8	To voucher No. 48		$30 14
		Expenses R. M. Hitt, board meeting	$30 14	
		Total	$30 14	
Dec.	9	To voucher No. 49		$40 00
		Postage for mailing out program of meeting	$40 00	
		Total	$40 00	
Dec.	17	To voucher No. 50		$21 12
		Expenses J. H. Christian, board meeting	$21 12	
		Total	$21 12	
Dec.	22	To voucher No. 51		$146 63
		R. P. Scurlock, drayage	25	
		E. W. Stephens Publishing Co	30 00	
		Columbia Telephone Co	4 65	
		Cash, telegrams and supplie	1 73	
		Postage	10 00	
		Salary, W. L. Howard	50 00	
		Salary, W. L. Driver	50 00	
		Total	$146 63	
Jan.	8	To voucher No. 52		$56 60
		T. H. Todd, salary of treasurer one year	$50 00	
		Expenses, trip to Randolph and Chariton counties	5 50	
		Expenses, January meeting	1 10	
		Total	$56 60	
Jan.	8	To voucher No. 53		$66 18
		R. M. Hitt, expenses, January meeting	$29 19	
		C. H. Dutcher, same	6 09	
		W. P. Stark, same	5 00	
		L. C. Wilson, same	16 62	
		E. A. Riehl, same	9 28	
		Total	$66 18	
Jan	19	To voucher No. 54		$49 15
		Expenses, L. N. Moore, hotel, Winter meeting	$8 00	
		J. H. Christian, expenses, Winter meeting	22 07	
		J. A. West, expenses Winter meeting	19 08	
		Total	$49 15	
March	31	To voucher No. 59		$217 65
		C. W. Wilmeroth, expenses Winter meeting	$31 80	
		L. N. Moore, same	16 60	
		T. H. Todd, hotel expenses, same	53 00	
		T. H. Todd, premiums	116 25	
		Total	$217 65	
		Grand total to vouchers		$2,509 50
		To balance		44 75
		To accounts unpaid, but due		5 33
		To balance		$39 22

NOTE—Vouchers No. 54 and No. 59 were delayed until the expense account came into the office, hence the date of each.

Respectfully submitted with receipts,

W. L. HOWARD, Secretary.

NURSERY AND ORCHARD INSPECTION.

In accordance with the wishes of the fruit growers as expressed at one of the sessions of the Winter Institute held at Columbia in January, 1909, the Board of Horticulture made an effort to safeguard the interests of the horticulturists of the State by preparing the following bill, which was introduced into the 45th General Assembly:

An act to provide for the inspection of nurseries and plants to prevent the dissemination of dangerously injurious insects and plant diseases, and to create the office of State Nursery and Plant Inspector, and appropriating funds for this purpose, with an emergency clause.

Be it enacted by the General Assembly of the State of Missouri, as follows:

Section 1. The State Board of Horticulture shall and is hereby authorized to appoint some person qualified by scientific training and practical experience, to be State Nursery and Plant Inspector, and he shall be responsible to the said Board for the performance of his duties, as prescribed in this act. The said inspector shall receive an annual salary not to exceed fifteen hundred ($1,500) dollars, and shall hold office for two years.

Sec. 2. It shall be the duty of the State Nursery and Plant Inspector to inspect, at least once every year, each and every nursery or place in the State where nursery stock is grown, sold, or offered for sale, barter or exchange, and if no dangerously injurious insects or plant diseases are found thereon, a certificate to that effect shall be given. If such pests are found thereon, the owner or owners of the stock shall take such means to suppress the same as the State Nursery and Plant Inspector shall prescribe, and no certificate shall be given until the said inspector has satisfied himself, by subsequent inspection, that all such pests or diseases have been suppressed.

Sec. 3. Any owner or owners of nurseries or nursery stock, or of places in the State where nursery stock is grown, sold, or offered for sale, barter or exchange, who do not hold an unexpired certificate of inspection after the first annual inspection made after the passage of this act, who shall sell, offer for sale, barter or exchange, or otherwise dispose of nursery stock in the State, shall be guilty of a misdemeanor, and in case of conviction, shall be punished by a fine of not less than ten ($10) dollars, nor more than one hundred ($100) dollars for each and every offense.

Sec. 4. The State Board of Horticulture shall, with the aid of the State Nursery and Plant Inspector, determine the season for inspecting nurseries and the form of certifcate to be given, but in no case shall a certificate be issued which shall continue in force after the 15th day of June next following the date of inspection.

Sec. 5. The following insects and plant diseases shall be considered as dangerously injurious:

San Jose scale (*Aspidiotus perniciosus*).

The new peach scale (*Aulacaspis pentagona*).

The wooly aphis of apple (*Schizonoura lanigera*); when in undue numbers.

The black knot of cherry and plum (*Plowrightia morbosa*).

Crown gall (*Dentriophagus globosus*).

Rosette of peach and plum.

Yellows of peach.

Brown tail moth (*Euproctis chrysourhaea*).

Gipsy moth (*Porthetria dispar*).

Sec. 6. It shall also be the duty of the State Nursery and Plant Inspector to carry out the provisions of the act approved March 1, 1901, Session Acts of 1901, page 134, which relates to the shipment of nursery stock into Missouri from without the state.

Sec. 7. It shall also be the duty of the State Board of Horticulture, through their agent, the State Nursery and Plant Inspector, wherever, in their judgment, there is good reason for believing any dangerously injurious insects or plant diseases exist on any trees, bushes, shrubs or other plants in any grounds, public or private, in the state, to enter said grounds and inspect said plants; and in case any dangerously injurious insects or plant diseases are found, to notify the owner or owners, or persons having charge thereof, in writing within fifteen (15) days, stating the nature of the insects or diseases found and the kind and extent of plants infested or infected, and the best method or methods then known to exist for the eradication or suppression of the same, and the time it should be done.

Sec. 8. If within a reasonable length of time after due notification, the owner or owners, or persons in charge of said infested or infected plants do not comply with the directions of the State Nursery and Plant Inspector, they shall be deemed guilty of a misdemeanor, and upon conviction shall be punished by a fine of not less than twenty-five ($25) dollars, or more than one hundred ($100) dollars for each and every offense.

Sec. 9. The State Nursery and Plant Inspector is hereby authorized, at all times between the hours of sunrise and sunset, to have the right to enter any public or private grounds in the state in the performance of any duty required by this act, and any interference shall be deemed a misdemeanor.

Sec. 10. It shall also be the duty of the State Nursery and Plant Inspector to make an annual report to the State Board of Horticulture, to be embodied and published in the annual report of the said board, showing the amount and extent of the work accomplished, the names, locations and conditions of the nurseries inspected, and the conditions throughout the state, regarding the pests and diseases embodied in this act, and also the disbursement of all funds appropriated for this purpose.

Sec. 11. There is hereby appropriated to the State Board of Horticulture out of any funds not otherwise appropriated the sum of five thousand ($5,000) dollars, for the carrying out of the provisions of this act.

Sec. 12. There being no adequate provision for the above control of the dangerously injurious insects and plant diseases of the agricultural and horticultural interests of the state, creates an emergency within the meaning of the Constitution; therefore, this act shall take effect and be in force from and after its passage.

At this writing (April 19th) the above measure has passed the Senate with an almost unanimous vote, and is now pending in the House.

House bill No. 575, a duplicate of the above, was introduced by Representative Calkins into the lower branch of the assembly.

REPORT OF TREASURER T. H. TODD, NEW FRANKLIN, MO.,

From January 1, 1908, to June 2, 1908:

1907.	Receipts.	
Dec. 31	Balance on hand,	$1,102 86
1908.		
June 2	Total disbursements	$606 13
June 2	Balance on hand	496 73
1908.	Disbursements.	
Jan. 24	Warrant No. 17	$31 40
Jan. 31	Warrant No. 18	120 00
Feb. 2	Warrant No. 19	112 43
March 31	Warrant No. 20	112 00
April 6	Warrant No. 21	17 30
April 11	Warrant No. 22	11 50
April 23	Warrant No. 23	21 50
April 30	Warrant No. 24	130 00
April 30	Warrant No. 25	50 00
	Total	$606 13

REPORT OF AUDITING COMMITTEE.

June 2, 1908.

President C. H. Dutcher, Missouri State Board of Horticulture:

Your Auditing Committee begs leave to report that it has examined the report of the Treasurer, T. H. Todd, together with all accompanying bills and vouchers, and find the same to be correct.

R. M. Hitt,
(Signed) W. P. Stark,
L. C. Wilson.

REPORT OF TREASURER T. H. TODD, NEW FRANKLIN, MO.,

From June 3, 1908, to January 15, 1909:

1908.	Receipts.	
June 2	Balance on hand	$496 73
July 3	By State warrant	1,500 00
Sept. 23	To State warrant	1,500 00
	Total	$3,496 73
1909.	Disbursements.	
Jan. 15	Total disbursements	$3,451 98
	To bills allowed and vouchers not yet received	5 53
	Total disbursements	$3,457 51
Jan. 15	To balance on hand	39 22

1908.		Disbursements.	
June	2	Warrant No. 26	$32 05
June	2	Warrant No. 27	140 50
June	2	Warrant No. 28	11 35
June	2	Warrant No. 29	13 10
June	3	Warrant No. 30	80 22
June	3	Warrant No. 31	49 93
June	3	Warrant No. 32	524 54
June	4	Warrant No. 33	90 79
July	1	Warrant No. 34	227 62
Aug.	1	Warrant No. 35	270 34
Aug.	24	Warrant No. 36	128 08
Aug.	31	Warrant No. 37	127 08
Sept.	21	Warrant No. 38	108 70
Oct.	13	Warrant No. 39	16 20
Oct.	16	Warrant No. 40	65 60
Oct.	21	Warrant No. 41	157 62
Oct.	26	Warrant No. 42	13 25
Nov.	11	Warrant No. 43	284 20
Nov.	20	Warrant No. 44	334 88
Nov.	20	Warrant No. 45	145 10
Dec.	1	Warrant No. 46	7 33
Dec.	1	Warrant No. 47	45 18
Dec.	8	Warrant No. 48	30 14
Dec.	9	Warrant No. 49	40 00
Dec.	17	Warrant No. 50	21 12
Dec.	22	Warrant No. 51	146 63
Jan.	8	Warrant No. 52	56 60
Jan.	8	Warrant No. 53	66 18
Jan.	19	Warrant No. 54	49 15
Mar.	31	Warrant No. 59	217 65
		Total	$3,451 98

REPORT OF AUDITING COMMITTEE.

Mr. W. P. Stark, President, Missouri State Board of Horticulture:

We, your Auditing Committee, beg leave to report that we have examined the Treasurer's accounts and find them correct, together with all accompanying bills and vouchers. Balance on hand, January 15, 1909, $39.22.

R. M. Hitt,
J. H. Christian,
Committee.

HOME OF THE STATE BOARD OF HORTICULTURE.
(Horticultural building, State University, Columbia, Missouri.)

SUMMER INSTITUTE.

Held at Mt. Grove, Wright County, June 2, 3, 4, 1908.

SUMMER INSTITUTE.

PROGRAM.

TUESDAY, JUNE 2, 8:00 P. M.

Music	Mountain Grove Orchestra
Prayer	Rev. C. A. Hicks
Song	Ladies' Quartette
Address of Welcome	W. S. Candler
Welcome from Wright County Horticultural Society and Fruit Growers	President Frank Horsfall
Music	Orchestra
Response	Prof. C. H. Dutcher, President Missouri State Board of Horticulture.
Influence of Music in the Home	Miss Kate Keller
Recitation	Miss Golda Henry
New Varieties of Strawberries	Dr. Paul Evans, Director of Experiment Station, Mountain Grove.
Solo	Miss Keller

WEDNESDAY, JUNE 3, 9:00 A. M.

Invocation	Rev. Hart
Publication of Committees named in meeting of Executive Board by President Dutcher.	
Obituary—Col. J. C. Evans, L. C. Wilson and J. M. Irvine.	
Resolutions—Louis Erb, J. C. Whitten and R. M. Hitt.	
Orchard Tillage	Dr. J. C. Whitten
Report of the Secretary	Mr. Geo. T. Tippin
How to Reach the Unsupplied Markets	Mr. Geo. T. Tippin
Cross Pollination	Senator H. M. Dunlap
Growing Tomatoes for canning purposes	Dr. W. L. Howard

WEDNESDAY, JUNE 3, 2:00 P. M.

Music ....Orchestra
Remarks on Apple Day at Missouri State Fair....Mr. G. T. Tippin
The Necessity of Spraying..................Mr. J. R. Haldeman
Selection of Peach Buds for Budding........Mr. Frank Horsfall,
Mountain Grove Experiment Station.
Peach Growing..............................Mr. W. C. Paynter
Visit to the Missouri Fruit Experiment Station grounds.

WEDNESDAY, JUNE 3, 8:00 P. M.

Music..............................Mountain Grove Orchestra
Song....................................Ladies' Sextette
Home Ethics...............................Mrs. C. A. Hicks
Violin Solo.............................Miss Cherry Simon
Duet.....................Miss Steiger and Mr. J. A. Kenreigh
Apples as a Food.............................Mr. Louis Erb
Recitation............................Miss Helen Kenreigh
Orchard Fungus Diseases..........Mr. F. M. Rolfs, Pathologist,
Mountain Grove Experiment Station.
Song.. Quartette
Recent Work Against the San Jose Scale in Missouri......
Mr. E. P. Taylor, Entomologist, Mountain Grove Experiment Station.

THURSDAY, JUNE 4, 9:00 A. M.

Prayer ....Rev. Needham
Hardy Peaches.............................Mr. R. M. Hitt
Large vs. Small Orchards.................Prof. C. H. Dutcher

THURSDAY, JUNE 4, 2:30 P. M.

Discussion—Best Commercial Varieties of Strawberries, opened by Mrs. A. Z. Moore.
Original Poem, "Ozark Beauty"..................O. T. Harmon
How Can Farmers be Influenced to Beautify Their Homes?..
Prof. J. C. Whitten.
Report of Committees.
Solo.........Miss Keller; Cornet, Mr. Kelly; Piano, Miss Keller
Ups and Downs of Apple Growers....Mrs. E. Hetherington Hodge
Music......................................Double Quartette
What are Some of the Most Desirable Shubs, Climbers and Plants for Decorating the Home Grounds? Discussion opened by Dr. J. C. Whitten.
Remarks by visitors of meeting.

WELCOME ADDRESS.

(By Mayor W. S. Candler of Mountain Grove.)

Mr. Chairman, Members of the Horticultural Association of the State of Missouri, Ladies and Gentlemen:

It surely gives me great pleasure, in behalf of the city of Mountain Grove, to have you as our guests tonight. When you had your last meeting in Columbia we extended to you an invitation to hold your next meeting in the Ozarks, in a city which, while not so large as some, yet is full of vim and push. When you selected Mountain Grove as the place to meet in 1908, our citizens said that June will be such a nice time, for then the visitors can see the growing fruit crop, but the weather man had something to say, and came along here in April and cut out a large part of our fruit. But you horticultural people are accustomed to such things as frosts, hailstorms, insects, bitter rot, bad transportation and very bad markets and commission men, who quote high-priced markets, but write you after your shipment to them to send a check to pay charges. I want you to forget your cares and troubles and accept the hospitality of Mountain Grove, a city which in time of the late money stringency kept right on with its improvements. Our banks did not have to resort to cashier checks, but paid promptly on demand made upon them. No better people live in Missouri than ours.

I desire to say that here on the Ozarks small fruits can be successfully raised, and what we need is more people with energy to engage in the fruit culture. We have here within one mile the Missouri State Fruit Experiment Station, managed by a most able corps of gentlemen. Now, this Station is the property of our great State, and I want each visitor to visit the Station while here. Carriages will be provided for your conveyance.

Now, in conclusion, we want to entertain you, so that you will all say we had such a nice time at Mountain Grove and was glad we met there. I thank you.

ADDRESS OF WELCOME.

(By Frank Horsfall, representing the Wright County Horticultural Society and Fruit Growers.)

Mr. President, Ladies and Gentlemen:

Our local Horticultural Society has requested me to welcome you. We wish you to have a pleasant and profitable visit among us.

We wish you to see as much as possible of our orchards and our methods of treating them. You can go in any direction from our town and you will see orchards on both sides of the road, some of them large, and I am sure you can find much of interest among them.

There are many visiting members present tonight who need no welcome from us, because they are so well known here, and they know that they are always welcome.

When you visit the Station tomorrow we hope to interest you in the many experiments under way. Mr. Evans has made ready for you, and I am sure he can make your visit a profitable one.

Again I wish to welcome you in behalf of the Wright County Horticultural Society.

RESPONSE.

(By President Dutcher.)

Ladies and Gentlemen:

You have doubtless noticed on your programs that, by virtue of the office I happen to hold, I am called upon to respond to the hearty welcome you have extended to the fruit growers here assembled, through your chosen representatives. Such greetings always do us good. The fruit grower's life is no easy one. He earns every dollar he has left to the credit side of his ledger. He does as much for nothing as any other man. He knows nothing he is not ready to give away, and sometimes has nothing he does not have to give away. The very planets, those mighty "stars" of Heaven, seem "to have it in for him" the most of the time, and gives him an 1899, 1901, 3, 4 and 7. For a 1900, 2, 5 and 6 he thanks them; but then the commission man gets him, and the grocer man pulls him 20 per cent. Jupiter, Saturn, Mars, Venus and Mercury played havoc with him last April, did better in May, and promises better things through June. In no part of the State will our crop be large this year, in consequence of their baneful influences, but what we have promises to be good. As long as we can make up in quality what we lack in quantity, we can afford to toil on.

While we shall try to appreciate the fullness of your cheerful greeting, some of us are not surprised. We knew we would meet with a hearty reception, for we well remembered those long tables, groaning under their weight of good things to eat, to which we were welcomed, over there in the public park, one September evening nearly three years ago, on the occasion of the American Pomological Excursion to the "Land of the Big Red Apple." We can yet see in memory sweet those stacks of fried chicken, yea, almost smell their delightful fragrance. You people did yourselves proud, and gave us all a splendid time. Even I myself, as some of you may remember, had a good time—a very good time, for one who knew that on the next morning he would take his wife to a hospital for an operation, the issue of which could only be guessed at. But such is life. Good and evil, joy and sorrow, riches and poverty, are all strangely blent in this life, and ever will be. The chariot wheels of some rich Dives will continue to throw dust upon the tattered garments of many a poor Lazarus. We can't help it. We must take the bitter with the sweet. We must not be discouraged, but ever remember that only he who holds on to the end of the race, can wear a laurel.

FACTS ABOUT WRIGHT COUNTY.

That those from a distance may know more of Wright county than possibly they already know, permit me to say to them, you are not visiting some Nazareth portion of Missouri. Wright county is in South Central Missouri, less than 45 miles north of Arkansas, and Mountain Grove is in almost the extreme southeast corner. The county lies to the west and north of us, and is almost wholly drained by the Gasconade and its tributaries to the Missouri river. It contains 432,000 acres of land, enough to make 5,400 farms of 80 acres each, and each rich enough to support a family of five, or a population of 27,000. Eight years ago it had only 17,519; hence room enough for 10,000 immigrants, who may want a home where they can make an independent living. The assessed valuation of the taxable property ten years ago was nearly $3,500,000, the full valuation of which was close on to $6,000,000. The value of her railroads was put at $382,000.

This county enjoys great advantages of soil, being a deep, sandy clay loam, and of sub-soil, being a red clay with gravel, and of climate, being mostly a warm temperate. From this you see at once that Wright is and ought to be a good fruit section. She has the soil, sub-soil and climate; has a northern slope and is well drained. No wonder she enjoys the proud distinction of being in the very heart of Missouri's "Big Red Apple Land" today, though in the early 30's she was known as "the land of honey;" for in those days the hollow tree furnished so much honey the natives could not find vessels enough to contain it, and had to store it in sacks made of deer skins. To us now, that circumstance of itself would be a good surface sign of the adaptability of the soil to fruit raising. No wonder the commission selected a spot in Wright county for the location of a State Experiment Station, and subsequent events have demonstrated their wisdom.

THE FRUIT EXPERIMENT STATION.

A short sketch of the life and work of this institution may not be amiss. The working life of the Mountain Grove Experiment Station is only seven years. The farm contains 190 acres, and seven years ago it was practically all in its natural condition. How much has been "brought under the yoke," I know not; but the experimental work may be, for convenience and ease of grasping, presented under four different heads:

1. *Variety Tests*—In this section there are today not less than 450 varieties of applies, 350 varieties of peach, 200 varieties of grapes, 200 varieties of strawberries, a considerable number of blackberries, raspberries, gooseberries, and others, possibly of less importance, have not been neglected.

2. *Plant Breeding Work*—The present results in the work of plant-breeding show fully 500 peach, near about 10,000 strawberry, 1,500 hand-bred apple seedlings, and about 500 seedling peach. In addition to this, about 60 varieties of seedling apples, and a like number of seedling peach have been obtained from many different localities, set out, cared for, and are now quite promising. These will all be fruited and compared with varieties in the variety orchard, and if found worthy, will be distributed to the growers of the State.

3. *Experimental Work*—There are also a number of blocks for experiments in grafting, budding, testing different methods of cultivation, testing different cover crops, and the means of fertilization.

From each of these departments we hope we shall, in the no distant future, be the recipients of much that will be very beneficial to us.

4. *Co-operative Work*—From this department of work we are even now receiving much that is helpful. The station is and has been carrying on co-operative work in different sections of the State, demonstrating the most improved methods of combatting insect and fungous diseases. If the workers have gone out into other territory, it has always been in contiguous territory, and none of us will object to that; for we all favor annexation of contiguous territory, whatever some of us may think about territory separated from the main land by stretches of water of greater or less width.

The entomological department is doing extensive work of this kind in fighting the San Jose scale in those sections of the State where this pest is known to exist, and other sections are being inspected as thoroughly as possible to locate all possible points of infection.

In this connection, I wish to call attention to a letter from Mr. C. Grandpierre of Greenville, Mo. He wrote: "I wish to be informed if your board has under consideration the passing of a law that would compel owners of fruit trees to fight diseases and pests. Our district has been remarkably free from diseases until now—January, 1908—but lately I have found cases of San Jose scale. Our natives do not do anything, and probably will see all their trees die before they get up and do things. The present state of affairs will put a serious check to the growing fruit industry in our section and prevent people from investing any more money in fruit plantations."

I referred Mr. Grandpierre to this station, and hope our two stations will in due time present the matter to our legislature. The Experiment Stations should, I think, take the initiative, but the board and every up-to-date fruit grower will help secure the necessary legislation.

These and many other topics will be considered during the sessions of this institute. To each and all of these sessions the citizens of the "Grove" are most cordially invited. We hope to say much that will do you good, and we know your presence will do us good.

INFLUENCE OF MUSIC IN THE HOME.

(By Miss Kate Keller.)

The hope of the nation is in the homes of its people. All progress, all institutions rest upon this basis; the broader the culture the purer the home life, the surer the foundation. A nation can never rise above its homes. The boys and girls of today are the men and women of tomorrow.

This is the problem which confronts us—the homes of our people. It seems to me, in our broad land, there are three classes of homes. Firstly, those over which preside loving mothers—mothers who are alive to their God-given duties—mothers who find their greatest happiness in the culture and education of their children—who spare not themselves in the inculcation of right habits of obedience and respect. These are the stay-at-home bodies, criticised, no doubt, by their neighbors across the way, who find time to spend at the club or elsewhere—out in quest of enjoyment, regardless of the whereabouts of their boys and girls, who are probably reaping the harvest of filth and degeneracy in the streets with others more or less learned in the ways and the language of the public thoroughfare. This is the second class.

In the third class we find the homes of many of the poor, who are so occupied with the bread-winning project that anything like proper home training for their children is entirely out of the question. Now where shall we find the solution of this problem? How can we mold into honest, respectable citizens these poor neglected bits of humanity? From the homes of the mothers in the first class come cultured boys and girls, trained for true citizenship. What more can be asked? She shall hear the Saviour's "well done."

The only remedy for the ills of the children of the other two classes lies in our public schools. There, if the teacher be alive to her duty—I say, if she is so—she will use every means in her power to overcome this lack of home training, this lack of proper influence. She will reach the dormant good through the channels of education.

Education does not mean a filling of the mind with facts—education is a leading forth. In this development there is no other one subject which can do as much as music. Music trains physically, morally—vocal music in that it requires deep and sustained breathing, develops the body and increases vitality. It gives greater powers of endurance and a stronger mental grasp.

A course in instrumental music is equal to a course in manual training. It trains the hand to obey the mind. Parents will find that a girl who is faithful at her piano practice will make a better "patcher" or "darner"—she will even turn a pancake more deftly. In fact, a properly trained musician is not a narrow-minded individual as man would have us believe; but, on the contrary, will pass through every walk of life better fitted for his chosen profession, better fitted to be of use to his fellow beings. He will be a joy to his family, because through the influence of music he has been led to feel and to sympathize more deeply.

Seek out the family who are lovers of music and you will find its members love their home; they find no other enjoyment equal to that of their own fireside.

When I speak of music, I do not mean the trash ground out in endless quantities—the short-lived popular music of the hour, which can not really be called song. Its own condemnation lies in the fact of its moment of popularity. My heart cries out for the children in whose homes I find the piano littered with this commercial article. What would be the result should an attempt be made to introduce into this home a "yellow-backed" novel or a "Diamond Dick?" Yet can we draw a distinct line between trashy music and this despicable literature and say this is right—that is wrong? "If your child asks for bread, will ye give him a stone?"

The child's future taste for music, yea, even his character, depends much upon the songs he is taught before he can read or write.

Mothers, teach your child of four or five years the lewd songs of the hour. Encourage him in singing at gatherings of old and young. He will be praised and laughed at—called "cute." By and by you will wonder what has made your child so forward—you will wonder how he has been "spoiled," so to speak. What were the songs you learned at your mother's knee? Better never sing at all than pervert the taste of a little child.

Learned men and women of today, men and women who have spent a life-time in this work, are giving us an endless variety of good wholesome songs for children. We can not miss them unless we close our eyes to what is pure and good. Remember, we are training in our homes and in our schools the men and women of tomorrow. In all good true musical training of today the idea of the pure, the simple, the natural, is predominant. Operatic music does very well in its place. When we are heart and soul hungry for a song, we want the simple, the sweet, the song which has its message, and that message told so well that it goes straight to the innermost recesses of our yearning being. Away with affectation and back to the simplicity of the dear bygone days! And so let us go singing—sing in our homes and out of our homes—sing when you are glad and be gladder—sing when you are blue and be uplifted to the higher and better things of life—sing when the sad hour comes and find healing for your sorrow. Let us go singing out of this world and up to the Eternal Throne. Music is a God-given privilege. Let us use it in all its purity—our homes will be happier, our lives more peaceful.

Give the children a chance. If necessary, leave out some other factor in their education, but never the music. A noted instructor in mathematics declares if some branch had to be dropped from his course of study, he would do away with mathematics but leave the music.

Now I feel as though I had said but a meager part of what might be told on the subject of music and its influence in the home, and I feel, too, that I have taken more time than was rightfully mine, yet I should like to leave with you this thought from David Starr Jordan. "Today is your day and mine, the only day we have; the day in which we play our part. What our part may signify in the great whole, we may not understand, but we are here to play it, and now is our time. This we know—it is a part of action, not of whining; it is a part of love, not of cynicism. It is for us to express love in terms of human helpfulness. This we know, for we have learned from sad experience that any other course of life leads to decay and waste."

NEW VARIETIES OF STRAWBERRIES.

(By Director Paul Evans of the Fruit Experiment Station of Mountain Grove.)

Mr. Chairman:

I am assuming that your secretary, in assigning me to this subject, had in mind more particularly the work we have undertaken at the station in strawberry breeding, and expects a discussion of this work, rather than a paper on the general subject of new varieties of strawberries.

The season is now so well advanced that it is impossible for me to show you a fair sample of the fruit, but I have here several boxes of berries taken from some of the later-ripening seedlings.

We have fruiting this year, or, rather, would have had, but that the frost took hand in it, 11,249 hand-pollinated seedlings, the result of forty-nine crosses. Thirty-one of these are primary, the result of crossing two known varieties; eighteen are secondary, or crosses of the second generation.

The main idea in making so many crosses at this time was to get a line on the result of crossing certain varieties. For instance, Warfield crossed by Clyde shows about 75 per cent of good strong plants, but in the second generation, where we have self-pollinated or crossed two of the seedlings resulting from the Warfield-Clyde cross, we have yet to find a plant with good strong foliage.

Minute-Man-Clyde crosses have probably given the best results as far as fruit is concerned, as well as a high per cent of good plants. Three-fourths of the plants are prolific, maturing a good crop of nice, large, well-flavored fruit, but all showing more or less the objectionable feature of its maternal parent—too soft to be a good shipper.

There are four hundred and forty-four plants in this lot.

Next is "878" X Clyde. "878" is a seedling that was produced by crossing Morgan's Favorite by Lady Thompson. The seedlings then from this cross carry the blood of Clyde, Lady Thompson and Morgan's Favorite. There are some good berries in this lot.

The next to be mentioned is a berry resulting from the cross of Minute-Man and "276." "276" is a seedling resulting from Clyde and Crescent. This lot has a high per cent of healthy plants, and some promise to be good, profitable, berries.

Next one is Aroma X Sharpless. It carries most of the good qualities of Aroma, and in some the color is improved by Sharpless. There were eighty-seven plants in the lot, and only eight were culled on account of inferior foliage.

From the plants resulting from the Gandy by Clyde cross, we expected to get something fine, but were somewhat disappointed. There are a few good ones, but nothing better than the parents.

There are one hundred twenty-two plants resulting from the cross Gandy by Aroma and only sixteen culled out on account of foliage. An unusually fine looking lot of plants, and we have good reasons to expect something good in this lot.

DISCUSSION.

Col. Evans—Has anything appeared in these seedlings that is better than anything that we have?

Paul Evans—It is hard to answer this on account of the conditions under which they were produced. I should have explained that there is as yet only one plant of each, the original plant from the seed. These are planted two and one-half feet each way and cultivated both ways. There is then but a single plant to be compared with a whole row in the variety patch. I will say, however, that while there was quite a good crop of fruit and some perfect berries in the seedling patches, there was no fruit on the variety patch of about three hundred varieties. It was not intended that there should be a fruiting test this year. We expect to simply cull out this year those plants that are worthless and give the good plants a chance to spread, so that we can make a fruiting test next year.

Mr. Tippin—Have you any crosses with Gandy and an early variety—say of the Warfield type?

P. Evans—Yes, sir; with Warfield and Johnson's Early, but the fruit is all gone now.

Mr. Tippin—The Gandy is the best late berry that we have, but it is too shy a bearer. The Warfield is the best of its season, but too small. If you could improve on those two points it would be of great help to the growers in south Missouri.

Mr. P. Evans—We have some crosses of Warfield by Johnson's Early. The per cent of good plants in the lot of Sharpless crossed by Clyde is small; there are very few good plants.

We have one resulting from McKinley crossed by "305." "305" is a seedling produced by crossing Warfield by Clyde. There are some very fine berries in this lot, but a large per cent are pistillate. All the fruit so far, with one exception, have the Warfield color, and there are some quite promising.

Another is McKinley crossed by Gandy. A few good ones, but a large per cent of the fruit runs small.

Aroma crossed by "305." There are some very promising berries in this lot. The Warfield color predominates and is much superior in size. This lot contains some of the most promising seedlings of the entire list.

"878" crossed by Aroma. "878" is a very large, light-colored seedling, resulting from crossing Marquis' Favorite by Lady

Thompson. About three-fourths of the fruit of this lot have the color of Lady Thompson and no resemblance in color to either of the parents.

The last to be mentioned is a seedling of Mrs. Hanna, crossed by "184," the latter being a seedling produced by crossing Barton's Eclipse and Clyde, that promise to be very good. The fruit is of the Warfield type, with as good or better color, reflex calyx and much larger. I am sorry that I could not have some fruit here to-night.

Mr. Tippin—The Warfield is one of the best shippers, but is apt to run small on account of being such a profuse plant-maker.

Dr. Whitten—I would like to ask that, in making these crosses, if fruit of one plant—usually the pistillate—is not the stronger; that is, if more characters of that plant are not noticeable?

Mr. Evans—In some cases it is, but I do not know whether it would do for a general rule or not. From my notes here I can give you no definite figures. I think this will have to be worked out by several seasons' trials. With the Warfield and Clyde cross I will get a large proportion of plants which are strong and free from disease, but this cross, self-pollinated, seemed much weaker, a smaller per cent of strong plants. Clyde and Warfield give good, strong plant, but No. 305, a seedling of this cross, self-pollinated, will show a very small per cent of strong plants. Yet we may get a few plants which are stronger than either parent or grand parent.

Mr. Erb—Have you any way to determine the shipping qualities?

Mr. Evans—No, except by storing them after picking and examining them from time to time. The Minute-Man crosses are nearly all soft berries. We can tell some by the looks whether they are soft or not. We have no refrigerator system to test the matter.

Dr. Whitten—I am very much interested in this subject. You spoke of certain crosses in which the large majority were promising. How may we know what to cross and what not to attempt? Are there any certain lines along which we may proceed and know about what proportion of inferior and superior crosses we may expect?

Mr. Evans—To a certain extent, yes. With the Minute-Man crosses we would throw out at least 75 per cent on account of being too soft. Of the Warfield crosses, fully one-half would go out on account of foliage weaknesses.

Dr. Whitten—The reason that I asked was because at the Station at Columbia we had Lady Rusk crossed with seventeen different varieties and failed to get one worth retaining.

Mr. Evans—We had some the same way, but if we produce enough plants to get one that is very good, we will confine our experiments to fewer crosses and grow more plants from each cross. This work was more to get a line on some of the best known sorts and find what the results would be by crossing with certain other varieties. That is the reason we made so many crosses.

Mr. Tippin—We had an object in putting on this subject. Strawberries may seem like small things, but they often have to bear the burden. They have this year. Two hundred and fifty car loads of strawberries have gone out of the strawberry district of Southwest Missouri this year and brought in $250,000. This calls to mind the importance of having strawberries in the locality. If Mountain Grove had grown this year twenty car loads of berries, Mountain Grove would have had $20,000 more money than she has today. So you see it is not such a small factor after all. The strawberry is one of the biggest things in the fruit industry in Southwest Missouri today. Probably you will now more fully realize the importance of the work at the Station. If the Station can give us a strawberry as good as the Gandy, as productive as the Aroma, and stand rain as well as the Warfield, it has accomplished more than most people would think. Very few people of Mountain Grove have taken enough interest in this work. You have not gone out to investigate it. The Aroma has only one really bad quality. On account of size, it is easily injured by rain. If we get a berry of Warfield quality and size of Gandy, whoever gives it to us, whether it be Dr. Evans or Dr. Whitten, will certainly be a great benefactor of the State.

Col. Evans—Would like to ask if Dr. Whitten can give us some hope along this line?

Dr. Whitten—Nothing more important than the fact mentioned; that is, to breed for the points we want and to get them to respond as we wish. But it is a mighty uncertain thing to predict what results you are going to get from plants. The work is limited, the results uncertain, and we have to breed a long time to get results that are not conflicting. That is the most important thing we learn. You can't breed with certainty. If a person can breed for a long time as Dr. Evans is doing, take careful notes on the work, go to the bottom of the thing and get facts. It will take several years to do this, and I believe we may reasonably expect to receive something from such an investigation that the results can be accepted.

REPORT ON CROP CONDITIONS.

(By Secretary Tippin.)

I have not prepared any written report for this meeting, as has been the custom in former years. We have been receiving a number of inquiries from outside sources as to the condition of the fruit crop in Missouri. We had hoped on a number of conditions that did not occur. Instead of seeing fruit in this section as we thought, and of seeing the different things being tried at the Experiment Statioin, the frost, which killed the fruit, also put an end temporarily to those experiments at the Station, and we have nothing therefore to report. We have a right to be discouraged, as there would have been things brought out in these experiments that would have been of inestimable value to the fruit growers of the State. However, we will have to bear with it another year and have better results then and more to report.

We took a great deal of pride in a report gotten out the 26th of April in which we said there would be a splendid fruit crop, but on the night of the 29th of April that report got froze and was of no value. Since that time we have received reports from which we judge that the fruit of the State will amount to practically nothing. It looks now as if the apple crop will show probably ten per cent, there being a fair crop of both Ben Davis and Gano. In the peach section it is thought that, if conditions are favorable for harvesting, that we have got some peaches. The Koshkonong district reports twenty-five per cent of a crop, but it is hard to determine just what the returns will be for the rest of the section. In all places the fruit was badly damaged.

HOW TO REACH THE UNSUPPLIED MARKETS.

(By George T. Tippin.)

The question, "How to reach the unsupplied markets," is perhaps the most important one to the horticulturist at the present time, unless it be the question of "How to create markets to be supplied." My answer to the first proposition is first, to remove, if possible, the obstructions that are in the way. The most formidable of these now is the power of injunction exercised by the Federal Courts to prevent State officers from enforcing just rates within the states. I am aware of the awe with which the average man looks upon a criticism of the action of a court, but it is not beyond the memory of men of my age, much less many of you who are older, when court decisions were rendered in the interest of a bond system and extension of bond territory, when the bond was black and in the form of flesh and blood. Such decisions in favor of special interests proved the last straw. Today the bond is white and written upon paper representing over-capitalization of the great arteries of trade to the alarming extent that, when the State of Missouri, by an act of the Legislature and an order of its Railroad and Warehouse Commissioners, fixes a rate on fruit within the State, although more than double the maximum rate on the same commodity in an adjoining state, they are enjoined by the Federal Court on the ground that it is confiscatory and unreasonable. Some may argue that this does not come within the scope of the discussion of the subject of markets, but let us see. That there exists today an expense between the producer and consumer which must either force down the price to the producer to cost of production or below, or force up prices so high to the consumer that consumption is destroyed, no one will deny.

If the problem of how to reach the unsupplied markets was solved, as far as getting our products to a given section of the great consuming public is concerned, and the price made to the consumer is beyond the reach of the masses, we have accomplished nothing in our own behalf, for the market is destroyed, but have contributed to the intervening unreasonable profits which are an estoppel to consumption and thwart the very object we seek to obtain. So long as excessive rates on fruit products form a large per cent of the expense that make the reach between the producer and consumer unsurmountable, and so long as we are charged 30 per cent more on car-lot shipments for a distance of 250 miles in the direction and to our natural markets than we are for 1,000 miles in the direction our markets do not lay, I must contend that the question of rates and court injunctions enter materially into the discussion of "How to reach unsupplied markets."

Other obstacles are to be overcome if we are to reach the unsupplied markets or are to create markets by facilitating a demand among which are the unreasonable profits insisted upon by those who handle our products, especially the retailer. I am also aware that in discussing this phase of my subject that someone will differ with me if on no other grounds than the claim we are antagonizing one business interest in trying to protect another, which claim is liable to be supported by newspapers of the cities, because the retailers are good advertising patrons of the press, but remember we are justifiable in pursuing any honorable policy to establish our business upon such relation to the trade as will insure a reasonable profit to us and at the same time place our products within the reach of the consumer at a price that is not prohibitive. If, in working out our plans to reach the unsupplied markets and creating markets, we are forced to run counter to some other interests, we do not do so out of a spirit of antagonism, but for self-protection, by applying the same rules of trade that are protected by other large productive manufacturing interests. We are only manufacturers, and if we cannot manufacture our goods and put them upon the market at a price that will insure consumption, then we must quit. If we are not succeeding in doing this, shall we make the effort? Let me assure you that we have nothing to lose in the effort, for the masses whom we desire to reach will not be prejudiced against us in our efforts to get to them with our products upon a basis that will guarantee to us a profit, so we can continue in the business of producing healthful fruits for their homes and at the same time allowing a reasonable profit for handling and not putting the price beyond their reach as consumers.

There exists today, between the grower and consumer of apples, an expense that is prohibitive to consumption, even where the price to the grower is only one dollar or less per barrel for the fruit. I brought this matter to the attention of the American Apple Growers' Congress at the annual meeting in August, 1906. At that time the jobbing price of apples on the market was $2.25 per barrel. The retailer was charging 40 cents per peck, or $4.80 per barrel, a profit of $2.00 per barrel after allowing 55 cents per barrel for shrinkage, which is 25 per cent of the cost price and a liberal allowance. In December the same year I made inquiry in another city of railroad men of what their families were paying for apples. They said 40 cents per peck. At that time the jobbing price was $2.25 per barrel. At 40 cents per peck, apples are a luxury to the masses; at 25 cents per peck they are an available, healthful food product, and consumption would be increased tenfold.

We cite another case in proof of this contention. During this last winter, at Montrose, Iowa, retail stores were handling apples, retailing them at 50 cents per peck, and did not sell an average of one barrel per day for each store, and that in a town of 1,200 people. Mr. F. H. Glancy, a dealer, decided to ship a car load of apples into this town. He got busy with the 'phone, not only with the town people, but also the farmers in the country, told the people that on a certain day he would have a car load of apples, and would sell them at $3.00 per barrel. The car arrived, and he sold 100 barrels in one day. Soon sold the car out, and ordered several more cars. In my home town, Springfield, retailers have been charging this winter 50 to 75 cents per peck for apples that cost them three to four dollars per barrel, and not one-fourth the apples have been consumed that would have been if they had been retailed at thirty-five to fifty cents per peck, which price would have yielded a profit of one to two dollars per barrel to the retailer, and for which he should be satisfied.

The people of the country will consume as large a crop of apples as has been produced when properly distributed and at a price that will pay a reasonable profit to the handler, and one dollar per barrel to the grower for the fruit on the packing table, and with short crops, at better prices, the same with all other fruits. The greatest commercial achievements in this country for many years have been through organized efforts. In recent years the most successful fruit and truck growing and marketing has been in those sections of our country where organization is most complete. The old proverb, "In union there is strength," applies with more force to no industry than it does to agricultural and kindred pursuits. The first essential in successful fruit growing is a proper knowledge of varieties and kinds adapted to the locality, and of the care and cultivation best suited to the soil to be planted. Second, a knowledge of the best methods of treatment to insure a perfect product. Third, a correct knowledge of the proper time and the proper way to gather and pack. Fourth, of the best methods of marketing, which, in my opinion, is the most important of all. We may successfully grow, gather and pack, and yet sacrifice all by not understanding how, or by not being in position to profitably market our crops or products, whatever they may be. By organization through which a community has all learned to grow and pack the same grade of fruit or to produce and put up the same class of goods, a greater inducement is offered to buyers, and better prices can be obtained, as a rule, than by operating individually. I would be glad to see the fruit growers in every section of the country organized into local societies. The local organization could then be made the unit from which a more extended co-operative and concerted movement could be formed, having for its sole object the proper distribution of our large crops. This, in my opinion, will be especially desirable and necessary whenever we have a general apple crop throughout the United States. I do not mean the formation of an organization to take charge of and sell the apple or other fruit crops of the state, but that through a co-operative effort a plan may be evolved that will be an instrument through and by which each association can market its apples and receive the same benefits, and at the same time have full charge of the sales of their products, whether it be on the track or in the market to which they have shipped. By an organization of a co-operative effort the expense of marketing could be minimized, so that shipments of thousands of cars could be made to unsupplied markets direct and be distributed direct to the people of the smaller towns and the agricultural, mining and lumber districts, thereby cutting out the expense of at least one local shipment, also one or two profits. By organization and co-operative effort this condition can be brought about, in my humble opinion. Through organization a power could be delegated to authorize representatives, who would formulate plans to this end. I believe if it were put up to the jobbing trade in our large cities in a business-like way, and they were made to realize that the producers must have some relief in this direction, their co-operation could be secured in regulating the matter of prices to the consumer. I would not want to antagonize the jobber or the retailer, and would recommend that an effort be made by co-operating with them to regulate prices on a reasonable profit basis. Failing in this, the only thing left to do will be for the apple growers of the country to establish apple depots or market houses in the large cities where the consumer can buy direct from the producer.

Through organization, the producer can incorporate into his business the same commercial methods that form the larger part of the success of most successful commercial industries of the country, and much can be accomplished, both in reaching the unsupplied markets and creating markets to be supplied.

CROSS POLLINATION.

(By Senator H. M. Dunlap, Champaign, Ill.)

There are many things not only interesting but highly important in apple growing. Varieties are the primary foundation stones of apple production. If we make a mistake here, it is a mistake for all time to come. All the pruning and cultivation, and all that which comes after, cannot undo this mistake. The last year or so have been "off" fruit years. This year the crop is very light in Illinois. It was light last year also. We have some apples this year; in a few orchards quite a remarkable crop, considering the season.

In the early days of horticulture, in the Illinois Horticultural Society, which originated sixty years ago, they used to talk more of cross pollination than of late years. We had no real grounded facts to work from, but many thought best to plant with that idea in view. Dr. D. B. Wier of Lako, Ill., conducted some experiments with plums about 40 years ago, demonstrating the necessity of having other varieties growing near them. This led other growers to group varieties for the purpose of cross pollination. On other fruits there was not much said until about 1893, when they began working out experiments along this line with pears in New York. They found there that Bartletts were often barren when planted alone. Careful experiments, where pollen was taken from one tree to another of the same and different varieties, were made. Some were self-fertile, but it was found that 63 per cent were sterile; that is, would not fertilize from their own flowers. Bulletin No. 5, Department of Agriculture at Washington, D. C., will give the history of this work. The influence of cross pollination is also shown on the fruit itself, on its size, color and its flavor.

Varieties of apples first came by planting seed. When we get a desirable apple we name it, and then we propagate by budding. If we propagated from seed we would not get the same variety.

When we speak of self-fertile varieties, we mean fertilized by same blossom or blossoms on same tree or other trees of same variety. I am not here to contend that the apple is self-sterile, but do contend that some varieties of apples are more or less self sterile, and when fertilized by pollen of the same variety have not the same vigor to stand various conditions of the weather, etc.

In Illinois, where there are large plantings, say twenty to one hundred and sixty acres perhaps, we have many orchards where plantings, of Ben Davis especially, are in 40 and 80-acre blocks of one variety. In these orchards I have observed for several years that they haven't had what you might call a bumper crop on the solid blocks of Ben Davis, when other orchards of mixed planting in the neighborhood have had some bumper crops. And in "off" years these solid blocks have failed often. Don't understand me to say that a proper planting of varieties will always assure a crop of apples, but I do say that you will stand a much better chance to secure a crop by mixed planting. I observed last year one orchard of 40 acres of Ben Davis apples which had one corner replanted with some dozen Akin. Only crop in this orchard was in this corner. I have observed many other orchards, and found similar conditions to prevail. One orchard in particular showed this to a remarkable degree. There were 120 acres where Akin ran 160 rods along one side of the orchard and Jonathan extended the whole distance alongside the Akin. The Ben Davis were next on the farther side of Jonathan. With Akin on one side and Ben Davis on the other the Jonathan had a good crop. But if you should go into the middle of the orchard you would find a light crop. The Ben Davis and Akin next to the Jonathan also bore a full crop. This difference was no doubt due to the proximity of the varieties and cross pollination. I showed some delegates through these orchards. Professor Waite of Washington was one of the party. His visit resulted in sending a special man from the department to weigh and make note of this experiment. They sent the men, two of them, who weighed and kept a close record, and some day we will get this report, and it will be very valuable. I could corroborate these statements in many cases. In my own orchard I had some Rome Beautys that were like some politicians—good promisers but poor performers. Last year conditions were different from the ordinary season. The bloom on standard varieties was delayed and ran over a long season. Rome Beauty bloomed out before the last bloom of other varieties were gone. In the case referred to, they grew near several other varieties and gave us a fine crop last year, owing, I am sure, to the cross pollination which was brought about by this late blooming. The same thing happened with the York Imperial. This brings up the question, is not the Rome Beauty, like the Bartlett pear, self sterile, and does not this account for the loss of crops in some instances?

I notice that most of my varieties which fail are late bloomers, and it may be that they fail because they are not planted alongside of some variety blooming at the same season. If we can, by any means, assure a crop on off years, it is worth much more to us than other seasons. Still, I recognize the fact that the elements may prevent a crop even then, but we will have provided the most favorable conditions for a crop by providing for cross pollination.

In the central part of Illinois the trees were just coming into bloom when we had two weeks of rainy weather, with the thermometer standing at forty to forty-five degrees during this time. These are the worst of conditions for blooming. There were no insects flying and the temperature was too low. I do not know what is the correct temperature, but we always get poor crops when the temperature is too low at blooming time.

In harvesting the apple crops, we usually carry forward four rows at a time, especially when we barrel in the orchard. One orchard on the place was planted in 1892. In this orchard we alternated different varieties of trees in the row. This was a bad thing to do and made expensive gathering. Planting four rows alternately of each variety makes it easy and economical to gather the crop, and you will accomplish the matter of cross-pollination without detriment to the economy of the harvest. It is important that we use varieties which bloom at the same season. These need not bloom the same day necessarily, perhaps, yet often the central flower is the only one producing fruit. So choose varieties coming in bloom at the same time.

The matter of what to do with orchards already planted in solid blocks is of interest to some of us having orchards fifteen years or so old. Most orchards of this age have some vacancies. In filling these places use different varieties, but those which bloom at the same time. If winter apples are in the block, and I was going to fill vacancies in the orchard, I would choose a summer variety. When picking the winter apples, the summer apples would be picked and out of the way before the main crop came on. If another winter variety is used, the men would often mix them up. Some apple pickers think all red apples are Ben Davis.

The pollen is carried by the insects and possibly by the wind. Some people say the wind does not carry it, but, however done, it is only for short distances that we can depend on cross pollination. I find first and second rows alongside of another variety well fertilized; the third row not so well, and the fourth row scarcely at all. Thus four rows can be pretty thoroughly fertilized if another variety is planted every four rows, as they fertilize from both sides. We can top-work an old orchard, and in this way, if every fifth row is top-worked, that would be sufficient. Or a person might top-work every third tree in that fifth row.

DISCUSSION.

Mr. Haldeman.—I have an orchard heavy in Ben Davis. Would Jonathan be good to put there?

Senator Dunlap.—Yes, I think it would. It is a good variety to grow and good to pollinate also. It blooms twenty-four hours earlier than the Ben Davis as a rule. The Akin is one of the strongest pollenizers we have. The orchard I spoke of, which has both Ben Davis and Akin in proximity, has a pretty fair crop this year.

Mr. Erb.—This is an important subject for us. I would ask whether a single variety, like the Gano or Black Ben Davis, would fertilize the Ben Davis. If so, there would be no trouble to gather all at the same time. Then, to save grafting whole trees, we might graft limbs here and there over all the trees.

Senator Dunlap.—I was glad to hear this question. While I am not prepared to say that Gano would cross pollinate the Ben Davis—and may get in trouble by expressing an opinion—but I believe that Gano and Black Ben Davis are but bud variations of Ben Davis, and consequently would not pollenize the Ben Davis at all. However, we would get self-pollination. In an orchard at West Salem, Ill., there is a tree of Rome Beauty that has apples of a plain red color. It is a Rome Beauty apple and tree, but the color is as distinct as the Gano and Black Ben Davis are distinct from Ben Davis. A person might use Akin. It is a red apple, and is shaped like the Minkler and about the same size.

Mr. Erb.—It could then be used with the Ben Davis. Is the blooming period at the right time?

Senator Dunlap.—The blooming periods are about the same.

Mr. Haldeman.—The blooming periods of Jonathan and Ben Davis are about the same. Then in the fall the Jonathan can be harvested and gotten out of the way before we gather the Ben Davis. The Jonathan produces a very fine fruit in this section, but it won't pack with Ben Davis.

Senator Dunlap.—No doubt that the Akin is a fine apple, but it is a little slow in coming into bearing for us. Generally twelve or fifteen years. I am top-working some trees with it but have not gotten good results. I am also resetting, using Grimes and Jonathan in Ben Davis blocks. The Grimes is my first choice, because there is no mistaking the color in harvesting by the men, and there is a great demand for the apple.

Mr. Todd.—I am much impressed with what Senator Dunlap has said. I have used the Missouri Pippin to set in my Gano blocks. I had an orchard with four rows of Missouri Pippin running alongside the Gano. Frequently, in gathering the fruit, I get apples off the Gano rows having not only the little white specks, but look like the Missouri Pippin in shape. And off the Missouri Pippin trees I get apples looking like Gano. You can not tell them from the Gano if they are taken away from the trees. I have also noticed that Gano rows alongside of the Missouri Pippin always have more apples than whole opposite side along by Huntsman Favorite, and all are managed the same. It is clear to me there is much in this subject.

Mr. Stark.—Along in '94, Parker Earle and our people began planting in New Mexico. We had advance information of Mr. Waite's Bulletin. Mr. Earle planted three rows of permanent trees and two rows of fillers. We received very favorable reports, and have gotten great crops of fruit there.

Mr. Candler.—Some years ago I bought some apple trees from an agent here. In the meantime I had received a pamphlet from the Stark Company recommending planting alternate trees. I planted about three rows of Ben Davis, then three rows of Winesaps, Black Ben Davis, etc., across the orchard. Two years ago I noticed that the Winesaps had few apples and the Ben Davis were very heavy. Is this the case of all fillers? Should the fillers be planted if they do not bear heavily?

Senator Dunlap.—All fillers do not bear heavily. But they should be planted if they will cause the other trees to make up the deficiency, and will cause the other trees to be more sure of bearing every year. I have heard of people who cut out their fillers after having planted them, but I never saw one of these persons. I do not think a person would in actual practice because of a desire to get one more crop.

Mr. Tippin.—You never saw a person who did it?

Senator Dunlap.—No.

Mr. Tippin.—You would like to see him?

Senator Dunlap.—Yes, I would like to see him. I would like to get his picture.

Mr. Tippin.—There is a man in this audience, Mr. Flournoy of Marionville. Mr. Flournoy, will you please stand up so that Senator Dunlap can see you? (Mr. Flournoy stood up. Laughter.)

Senator Dunlap.—Did you cut out fillers?

Mr. Flournoy. Yes, sir.

Mr. Dunlap.—All right. You are the only living man of your kind. Send me a "photo."

GROWING TOMATOES FOR CANNING PURPOSES.

(By Dr. W. L. Howard, of the University of Missouri.)

The tomato is a vegetable that is universally popular, whether cooked or served in a raw state. It is produced as a field crop for early and late markets; is forced under glass out of season, and is grown for canning purposes. As a field crop, every energy is bent toward securing the ripe fruit as early as possible, for it is the first shipments that bring the fancy prices. When forced, early maturity is also desirable, as the expense of maintaining growing crops under glass is very great.

Growing tomatoes, either under glass or outside, for early markets are industries that belong to professional gardners, while their production for canning purposes is peculiarly the business of the small farmer. This is true because the man who cultivates from twenty to forty or fifty acres in the various farm crops, should practice diversified farming. A man with a large farm, in addition to his crops, will have broad acres in pasture, and, consequently, large flocks of animals, which he can market to more or less good advantage at any time, while the small farmer is dependent upon his corn and wheat crops to support his family and make necessary improvements, and therefore suffers serious injury if there is nothing worse than a partial crop failure. Moreover, in handling the staple crops—corn and wheat—on a small scale, there will be a season when there is a period of comparative idleness. This is the period following wheat harvest and after the corn is "laid by," which usually includes the whole month of August, and perhaps more. If there are several in the family, the problem becomes a still more vital one. Growing tomatoes for a cannery will furnish employment to an entire family during the time when it would otherwise be idle or its labor unprofitable.

No farmer should undertake to grow a large acreage of tomatoes. The biggest profits, relatively speaking, are always made on the smaller areas. Because a man makes seventy-five or one hundred dollars clear money on a single acre—which has often been done—it does not by any means follow that he can multiply the acreage by ten, twenty or thirty, and continue to profit accordingly. But because of this false reasoning, mistakes of this kind are often made. If a man can be satisfied with an annual profit of from one hundred to three hundred dollars on his entire planting, he is reasonably certain to secure it, but if he strives to go beyond the maximum sum mentioned, he stands in great danger of securing no profits at all. This is because the amount of land he can cultivate in tomatoes, without neglecting his corn and other crops, is limited; also, he cannot harvest and market too great an acreage to good advantage.

As has been intimated, the average farmer should grow tomatoes only as a side line. If he can make up his mind to do this and goes into the business with the expectation of working a little bit harder than he might otherwise do for a brief space at planting time, and will not become excited over his big profits on a small investment and become a plunger the next year, it is the firm conviction of the writer that there is no crop that promises such safe and large returns as tomato growing.

ACREAGE.

It is advised that the farmer grow from one to four acres of tomatoes, depending upon the amount of help he has at his command. Planting tomatoes and harvesting the fruit is work that can be done by men, women and children. Of course, if this labor had to be hired the profits might be small, but this is exactly wherein lies the value of the crop to the small farmer, since his otherwise unprofitable help can thus be utilized to good advantage.

GROWING THE PLANTS.

The grower has little or nothing to say about the variety to be grown, as this is a matter that is usually decided by the factory management. As a matter of fact, the Stone is the principal canning variety, with the Perfection to sometimes prolong the season. The factory nearly always supplies the seed to the grower, the usual basis for reckoning the amount being one ounce to the acre,

i. e., that one ounce of seed will produce enough plants under ordinary methods of growing, to set an acre of ground. It would probably be much better for all concerned if the factory would raise all of the plants and supply them to the growers at a reasonable figure, say half the cost of production. It is believed that the factory could well afford to lose half the cost of production. Under such terms, the growers should receive their plants at a cost of not more than five cents per hundred, and the average grower of some experince would far rather pay this price than to be at the trouble of growing his own plants.

The plants should be forced at least slightly, in order that they may be large enough to be set in the field as early as possible consistent with cost of production. In South Missouri, they should be set in the field the first week in June, at the latest. A convenient time for setting would be just after the corn is planted and before it is ready for the first cultivation, but this cannot always be done.

In practice, the plants are usually grown on a spot of ground where a large brush heap has been burned. The fire not only kills all weed seeds that might be in the soil, but the soil itself is thought to be improved by the addition of the ashes. The earth is spaded up and the seed sown about the first week in April.

This method of growing the plants is not ideal by any means. The chief objection to it is that the plants are not early enough. If the plants are not set in the field before the middle of June there is great danger that the crop of fruit will be cut short in September by an early frost. This has occurred a number of times, and might have been prevented by setting the plants two weeks earlier.

In order to secure early plants, they should be grown in hotbeds. As a rule, however, the growers will not take this precaution, and if early plants are to be secured, it seems that the factories must grow them themselves.

Hotbeds for growing tomato plants need not be very elaborate affairs. Indeed, the simplest form of open bed would probably do as well as any. The site should be a sheltered situation where north and west winds are cut off, but with full exposure to the sun. Fresh barnyard manure, such as the daily cleanings from livery stables, should be spread to a depth of eight or ten inches and the mass inclosed with boards or other timbers. Over the manure should be a layer of rich soil, such as chip-dirt or thoroughly rotted manure or straw. The layer must be four or five inches

Acc No 5986

deep, and if rotted manure is used, the bulk could be made up of about one-third good garden loam. Four inches of garden soil could be used and then an inch of chip-dirt spread on to prevent it from baking.

Covers for such hot-beds as have been described, may be made of cloth instead of glass. Glass would not only be very expensive, but is unnecessary, as covers will be needed only a few nights when there is danger of frost. By covering with boards, over the cloth, and placing a tub of fresh well or cistern water inside, even a hard freeze could be survived. A light domestic makes a desirable cloth for the covers.

The beds will have to be watered frequently to insure a uniform growth.

The seed should be sown shallow, say about one-half inch deep, and the surface compacted with a board, which may serve as a walk for crossing the beds while sowing. The seeds may be sown in drills three or four inches apart or in two-inch strips, with three or four inches of space between.

After the plants are an inch high the soil should be stirred. This stirring should be repeated frequently, particularly after each rain, as it induces more rapid growth and more freely admits the warm air to the roots.

SELECTION OF SOIL.

Tomatoes for canning factories are usually grown on newly cleared land, if such is available, because fresh land is not only fertile, but because it is free from weeds and is easily tilled. Any soil that will make good potatoes is adapted to tomatoes. Poor soil that will not produce good average farm crops should not be planted to tomatoes without using some kind of fertilizer.

If new land is not available, it will pay to give close attention to the previous cropping. In reasonably strong soil corn is not a bad crop to precede tomatoes, but clover and cowpeas are still better.

The plants are set in the field in rows four feet apart each way, thus requiring a little more than 2,700 per acre (2,722). Cultivation should begin immediately, in order to conserve the moisture from the first. The first cultivation should be deep, and gradually grow more shallow as the season advances, so as to not injure the roots.

On new land tomatoes are seldom cultivated more than two or three times. While the plants respond to good tillage, they can withstand considerable neglect, particularly if rains are frequent in July.

FERTILIZERS.

In the great majority of cases it will not be necessary to use commercial fertilizers of any kind. Experience has shown that previous cropping with clover or cowpeas or the use of barnyard manure will solve the fertility problem. The manure is perhaps best used (and nearly always is so used in practice) by marking off the rows one way with a marker, laying them off the other with a bull-tongue plow, and then throwing a forkful of manure in each check. This manure must be well rotted. In setting the plants the manure is placed in the furrow first and the plant set on top of it, using a small amount of soil over the manure, so that the latter will not come into contact with the roots immediately. A handful of guano has been used in similar manner, instead of the manure, but was much more expensive and not nearly so satisfactory in its results.

If commercial fertilizers are to be used, it should be borne in mind that the tomato belongs to the potash-consuming class of plants, and hence a relatively large amount of this material should be used. It it not to be understood, however, that it is not necessary to apply nitrogen for certain soils are notably deficient in this element, and it must be supplied in the form of fertilizers. Nitrate of soda is one of the best forms of nitrogenous fertilizer to use, as it is easily dissilved by the rains and is quickly and fully absorbed by the roots, thus encouraging an early and vigorous growth of plant and a normal development of fruit. The following formulas are recommended:

For a reasonably good soil for one acre use:

Nitrate of soda	100	pounds
Bone tankage	175	"
Acid phosphate	100	"
Muriate of potash	125	"
Total	500	"

On a poor soil, for one acre use:

Nitrate of soda	250	pounds
Bone tankage	250	"
Acid phosphate	200	"
Muriate of potash	300	"
Total	1000	"

Fertilizers should be applied to the land a week or two before setting the plants, if possible, as disastrous results will surely follow if the roots come into contact with the fresh salts. The acid phosphate gives best results when plowed under along with cowpeas or other crops. In the presence of decaying organic matter, the phosphorus is released and thus becomes available to the growing plants. Nitrate of soda or other nitrogenous salts may be applied to the hills alone, but their use in this way is not advised, since the danger is very great that too much would be employed and the plants killed. With a little precaution, it is perfectly safe to use well-rotted manure in the manner described.

APPLE DAY AT THE STATE FAIR.

Secretary Tippin spoke regarding Apple Day at the State Fair. He said in part: "As Superintendent of the Horticultural Department, I want to call your attention to a National Apple Day inaugurated at St. Louis in 1904. I would suggest that the proper thing to do next fall at the State Fair is to observe the National Apple Day. Missouri should, as a State, lead in this matter of observing an apple day. I wish you would keep this in mind when you are gathering your fruit for display this fall. I would like to hear the views of the fruit growers assembled here. I particularly wish to hear what Mr. Stinson has to say regarding this subject.

Mr. Stinson.—It seems to me that this proposition is a splendid scheme to advertise Missouri as an apple State. We have a splendid apple State. All over the country people look to Missouri for apples. It seems to me we could make a good hit by observing Apple Day at our Fair. There was nothing that more widely advertised the State at the St. Louis World's Fair than did Apple Day. Nothing would more vitally interest the people of this and other states than such a day.

It was moved by Mr. Tippin that the sense of this proposition be observed at the Fair beginning October 3rd at Sedalia. Motion was carried.

THE NECESSITY OF SPRAYING.

(By J. R. Haldeman.)

If there be any good in spraying, we, as horticulturists, want to know it, and to know how to appropriate that good to ourselves;

and this can only be done by careful study of the question from start to finish.

There was a time when, in this country, and, in fact, all new countries, that spraying was not needed, and those days are referred to now in defense of the theory that spraying is not necessary now; but the seasons and environments have changed since then. The prairie fires of the Indian (which destroyed the insects that now pray upon our orchards and our mutual friends, the birds) have ceased and disappeared from before the onward march of the settler.

There are so many more orchards now, and too many of them are breeding places for the increase of the orchard pests.

These factors in our environment have changed the situation, and as the conditions have changed, so we are face to face with a new problem; at least, practically so.

Now what is to be done? There is but one thing to be done, or rather one of two things: Either we must spray our orchards or abandon the fruit business altogether; and the question is, which shall it be?

We see the disfigured fruit and depreciated fruit crops before us from year to year caused by the codling moth, tent-caterpillar, apple scab, leaf-roller, the borer, the aphis, the crown gall, brown rot, bitter rot, oyster shell scale, San Jose scale, and a host of other insect and fungous life that infest our orchards. They loom up before us in their majestic proportions, a mighty destructive army, so that the fruit grower is appalled as he contemplates this innumerable host marching to meet him each returning spring. There are very many who think that spraying is of no avail—that it does no good.

They have never tried it, and therefore have no experience in the case, and, of course, are not competent judges on the subject. But there are those who have had experience in spraying, both with the liquid and with the dust process, who, we think, are competent to testify in this matter. The great majority of fruit growers have never sprayed and know nothing about it. When they begin to investigate, they turn to the Experimental Stations for light on the subject, yet they find that although the Experimental Stations have been carefully and patiently working with the liquid system for over 20 years, yet the subject is dark, and they are still experimenting. The French (over 20 years ago) gave us the Bordeaux Mixture, that is, 4 to 5 pounds of sulphate of copper and 4 to 6 pounds of lime, and 50 gallons of water.

It is true that with the experiments we have made we can better mix the ingredients that at the first. With the improvements in pumps and nozzles, we can spray it on the trees in better shape than at first, but have not progressed very far within the last few years.

Arsenate of lead has been used with success in some of our northwestern states and elsewhere with good results. Some use Paris green and some concentrated lye, and for San Jose scale, lime-salt-sulphur wash with success with the liquid system. We all know that water is only used as a conveyer, as it has no virtue in itself, but as a conveyer it is very bulky and cumbersome, as well as inconvenient, and there is in its use a very great waste—a loss of 20 per cent, and the foliage is often badly burned, and sometimes the fruit is rusty-coated and injured, but with care much good has, and can be, accomplished with liquid spraying.

There has been for the last six or eight years a growing sentiment in favor of the dust system of spraying.

This system has many good features, and some that are not so good. Now, hydrated lime is used as the conveyer, and mixed with this are many different ingredients—powdered copper sulphate, flowers of sulphur, arsenate of lead, Paris green, concentrated lye and many other poisons; and they are very readily incorporated with the hydrated lime, making a fine, fluffy spray, which can be blown into the foliage of the trees, plants and shrubs with compressed air, usually produced with a fan, and if sprayed early in the morning, while the dew is on the leaves, it deals death and destruction to all insect and fungous life.

The application is much easier than the liquid, and it can be applied more economically and much more pleasantly than the liquid can, and is much more thorough. The liquid falls upon the top of the foliage only, while the dust is blown into the center of the tree going to the under side of the leaves, as well as upon the top side, and if an apple hangs with the calyx down, the dust enters it, as the dust entering among the foliage by compressed air is forced in every direction. Gravity carries the liquid to the ground, hence the very heavy loss; but the dust fills the air and is carried to other trees besides the one being sprayed, so there is practically no loss. As I have said, the sentiment is growing in favor of the dust spray: First, because of its cheapness, and, second, because of its effectiveness.

SELECTION OF PEACH BUDS FOR BUDDING.

(By F. Horsfall.)

Some sixteen years ago I had the honor of receiving my first lesson in peach budding from our respected secretary, Mr. Tippin. At that time, if I remember correctly, Mr. Tippin told me first to select vigorous, healthy trees of the variety desired from which to cut my buds; if possible, trees of known merit and marked superiority over others of the same variety in respect to vigor and productiveness. From these trees cut only such twigs as carry strong, plump, well developed buds, which have good leaves attached. These instructions are exactly right, and I can add nothing to them today. However, I believe I can interest you in some results of an experiment that show the value of these rules.

Most nurserymen with whom I have come in contact do not follow these instructions, but select their buds at random from any stock of the variety desired. No attention is paid to the kind of buds cut or the condition of the leaves attached. When budding in the field all buds are used, regardless of their condition.

I have given you the correct method for selecting peach buds and the one commonly practiced in propagating the peach. Now listen to the results of the two when carried out side by side in an experiment.

In the fall of 1907 an experiment was undertaken to ascertain why a high percentage of living buds is not always obtained when commercial budding is done. Five lots of buds were chosen which differed from each other in some important point. These were budded as nearly as possible alike, and the experiment was repeated four times during the budding season. In the spring, after the buds started into growth, the percentage of living buds was taken for each kind of bud used. The results were astonishing. Here are the average results from the experiment, which was repeated four times: The first lot of buds were well developed, with good, healthy leaves attached, and were cut from strong, vigorous trees. From these buds I obtained 98 per cent of living buds.

The second lot of buds were well developed apparently, but were cut from trees in poor condition, and the leaves attached were diseased. Here I succeeded with 65 per cent of the buds.

The third lot of buds were good buds, cut from vigorous trees, but were without any leaves attached. With these buds I got 65 per cent to live.

The fourth lot were poorly developed buds, but with good leaves and from vigorous trees. From these buds I obtained only 12½ per cent of living buds. However, nearly all the bud shields grew fast to the stock, but the bud did not develop in the spring. These are commonly thought to be alive, but, in fact, the buds themselves are dead.

The fifth lot were poorly developed, without leaves, and from trees in poor condition. Only 4½ per cent of these lived.

From the average of these five lots of buds we got 49 per cent of a stand, which fairly represents what may be expected if no selection is made. However, if undeveloped buds are thrown out and only the first three lots are used, which is usually the case, there will be an average stand of 76 per cent. This, I believe, is about what the average nurseryman expects. If the first lot of buds is a fair sample of careful bud selection, then the nurseryman could expect 95 per cent of a stand. It is easy to see from these results that it would pay, and pay well, to select carefully the buds for peach budding. Budding is a slow and trying operation, as we all know, and if the nurseryman can get a full stand by a careful selection he can save much hard work.

In addition to the gain in buds, might be added the chance for more vigorous trees from selected buds. It is often asked why certain trees in an orchard are more vigorous than others. Who can say that it is not due, in part at least, to the buds from which those trees were grown? Like begets like, is a law as old as life itself.

DISCUSSION.

Mr. Haldeman—Do you pay any attention to the past history of the tree?

Mr. Horsfall—When I spoke of a thrifty tree, I meant one covering productiveness as well as other points. When possible to do so, I would take buds from specially chosen trees. We are carrying out this experiment on Ben Davis apples at the Station.

Mr. Dutcher—What time of year is the time for budding peach trees?

Mr. Horsfall referred the question to Mr. Tippin, who had budded more peaches, who in turn referred it to Mr. Stark, who answered as follows: It is a condition of sap rather than time. Sometimes July is the best time, sometimes it may be earlier.

After the bud has become vigorous and the bark does not cling to the tree tightly, one may bud successfully. I might say right here that it only pays to propagate from mature, vigorous, well selected buds. I am of the same opinion as Mr. Horsfall, that we can raise the percentage very noticeably by selecting our buds from healthy trees. The care of the tree the season previous will, of course, have a great influence upon the bud itself.

Mr. Dunlap—Has anything been done towards budding apples?

Mr. Stark—Yes, we have done quite a lot of work along this line.

Mr. Dunlap—What time would you bud?

Mr. Stark—Just as soon as you can get the buds. I would do it right now (June 3), just as soon as I could get to it.

Mr. Dutcher—Do you think June is too early?

Mr. Stark—No, not for apples. It is too early for cherries on Mahaleb. Mazzard stock will stand earlier work. Morello stock should be budded very early.

Senator Dunlap—About top grafting, I find best time is very early, much earlier than budding. Just as soon as the buds begin to swell or after the leaves get out. However, I have had considerable of a failure with some of my top grafting.

Mr. Stark.—I should consider top grafting is a matter of condition rather than of time. I would begin as soon as freeze is over and continue until quite late. However, it succeeds best with early work.

Mr. Howard.—Our Short Winter Course work coming in January and February at the Agricultural College, we must then give practical instruction in top-grafting in these months. The students do the grafting themselves, and many of the grafts live. In June and July we have other students (in the Summer Courses), who also do this work, and many of these grafts live also. I merely mention this to show the wide range of time.

Mr. Erb.—I had some grafting done in February. I had four men come down from Michigan to do the work, and they top-worked 1,500 trees, beginning the 15th of February and working until the 10th of March, and I must say that the work was a success. Hardly any of the trees but what are doing well. February was a mild month, but no buds had started.

Mr. Howard.—I do not want to leave the idea that February and June are the best times for top-working trees for successful results, but these are the extremes in which we have tried it. The best results have been obtained when the work was begun just as growth began. So I am quite sure that season has something to do with it. One season we tried it with the buds just beginning to swell and the next season we tried it with buds open and leaves beginning to grow, and got about the same result.

PEACH GROWING.

(By W. C. Paynter of Koshkonong.)

I came to this country in 1894 and began to grow peaches in a commercial way. I had had no experience in growing peaches. I found that nearly every man I met had a different idea about how to do this work. There was no set rule. There was no criterion to go by, even for planting. I had to outline plans and experiment. The land we chose was like most of the other Ozark land in this vicinity. We cleared the land and fenced it. There were plenty of rocks and stumps which, with the roots, made the ground hard to prepare. In fact, the preparation of new land costs more than most people are willing to put into it. I have come to the conclusion that with most people it is not advantageous to plant on new ground. However, we do plant a good many acres on the new ground and get very satisfactory results when care is used to get it broke up well. Unless this is done, failure is sure. But since time is money, one must take the chances with new land. Nine out of ten who go into the peach business and fail, fail because they start wrong. Hence, I would emphasize the importance of planting right. From Springfield to Thayer, I can cite instances of failures due to wrong methods, the wrong methods of planting, locality and care afterwards. If you are going to start on new land, you would do well to put four good mules or horses on a steel plow after the ground is cleared and break both ways. Do it thorough. If you do it right, it will cost you ten dollars an acre. We have found it better to plant one year in corn or some cultivated crop. Next year break again with four horses and put the soil in good workable condition, and you ought to have it in good shape for planting a peach orchard.

Now as to trees. Set the best trees you can get. There are always good trees to be had if you are willing to pay for them. I would not have a small tree if I could possibly get a bigger one. I would wait a year to get big trees rather than plant a small one. We used to dig a big hole, set in the tree and fill this hole up again, which cost us from three to five cents per tree for setting. We now set trees for something like one cent each. We prepare the trees for planting by close pruning. We cut the tap root to two inches and the side roots from one to one and a half inches. Then, when we start to plant, we take a bundle of trees in one hand, a mattock or good strong hoe in the other, and start out. We dig a small hole, set in tree, tamp the dirt good and go on. You can't plant in this way unless you have the ground thoroughly prepared. We have been following the practice of growing corn the first year, but do not think that is the best way, but we have tried to make the ground pay something before the first orchard crop comes on. There are no orchards in my vicinity that have been devoted exclusively to peach growing. I believe it is a better plan that while we are growing the orchard not to try to take anything from the land, but rather try to add to it. After the trees are planted we usually cut them back to 18 or 20 inches high. The next spring we prune one-third to one-half of previous year's growth. Then do the same thing the second year. Get the tree just as big as you can and make the tree at three years of age big enough to hold three crates (six baskets to crate) of peaches. We don't always succeed in doing this, but we try.

We have planted a great many acres in peaches, and in order to avoid planting in patches, planted both hill and low land alike. We have found that low land is no good. There is only one place to grow peaches—on top of the hill. It is the top of the hill where you get your good peaches, and it is the top of the hill where you get your peaches in off years. It is a good thing to know where to plant. If you are not sure, consult with some experienced man who does know and take his advice. Keep to the high places. You are not planting for scenery, but are planting for peaches. Avoid any basin or low place, where cold air can back up. We can see the frost line on the peach trees as distinct as you can find the water line in a stream. We are now having our third crop on the high places of one orchard, and have had practically nothing from the low land. Observe these things also in your own orchard. Nature is pointing out the lessons for you. You can't afford to do a thing after she has said not to do it.

In conclusion, I would say get the land in good shape; use good trees; give these trees good attention, all the attention you can; prune; cultivate; feed by crop rotation and by fertilizers; plant on top of the hill, and the peach business will pay. I don't know of anything that will pay as good or as sure a dividend. Other fruit pays well, but nothing pays like peaches. A six-year-old orchard is a pocket full of money, and you don't need over 15 or 20 acres unless you want to be a millionaire.

DISCUSSION.

Mr. Wilson—Mr. Paynter said it was best policy in the Ozarks to stick to the top of the hills. From my experience, I believe it is better to stick to the top of the hill any place in Missouri.

Mr. Paynter—This statement especially suits the Ozarks because of the fact there are so many hills and valleys, and cold air flows down these valleys just as water does. On our place we have peaches on the hills when there is an absolute failure on the low lands. I do not know but that this statement would hold good for other sections of rolling land as well.

Mr. Chandler—What difference, if any, would be made if planted on hill on south or north slope?

Mr. Paynter—There is no difference in slopes with us. We have all kinds. Northeast slopes seem to grow the best trees as a rule. One slope seems to be as sure as other for fruit. Last year fruit was best on north slope; this year we secured a heavy crop on south slope. There is twenty-five per cent more on the south slope than there is on the north slope. I wouldn't make any material difference in the slope, just so long as I could stay up high enough.

Mr. Erb—This matter of elevation or slope applies to spring frosts in the Ozark section. The same is true of slope. However, the main trouble we have with peaches is winter-killing. After peaches have gone through the winter, spring frosts sometimes kill, because not high enough. But in winter-killing, on high or low land, if the thermometer drops down five to fifteen degrees below zero in December or January, or even in March sometimes, then there is no damage for spring frosts to do. Spring frosts are exceptions to Missouri. We have suffered the past two years. In New York the temperature went to 25, and even to 30 degrees below zero, and yet a peach crop is reported. No peaches here and the temperature was only 5 to 10 degrees below. Why? Winter-killed. That is our main trouble.

Mr. Paynter—I can answer that difficulty. Most of the information and advice that I have had from experts on the subject is to the effect that the buds wake from their cycle of maturity too early. Cultivation will remedy this by prolonging the maturing of the buds in the fall. If we cultivate late and keep the trees growing late, they will wake up later in the spring. If you will notice the trees that have the most fruit on them, you will find they are the trees that grew latest in the fall. If a tree matures its buds too soon, they will pass through the cycle of maturity and wake up on the first warm days of early spring or late winter. I prefer to have trees green until late in the fall. This year we intend to plow our trees until near frost time. We don't want them to mature buds, but want them to grow late and freeze and stay froze.

Mr. Erb—I would like to ask if, in cultivating late, say, until the middle of October, will buds develop and swell so as to be caught by cold snaps? Does cultivating late keep them in dormant condition? This is the only country I know of where they shed their leaves in summer and early fall. They get matured early in the summer, and are ready to grow again in the middle of winter, and get caught by the first cold snap afterwards. What can we do to keep them dormant?

Mr. Paynter—There is one general rule to follow: Force wood growth and keep buds from maturing until later in the fall. Cultivation seems to be the easiest method to do this. Spraying has been suggested by some. The main thing to keep in mind is that the growth must continue up until almost frost time. If you do this, peaches will not wake up in midwinter to be frozen.

Dr. Howard—This matter pertaining to the hardiness of peach buds in relation to the rest period probably demands an explanation. As Mr. Paynter has brought out, every tree has a certain dormant season, or rest period, in which it is inactive. Every peach tree remains dormant a certain length of time before it will wake up again. Mr. Paynter says by ceasing cultivation the trees were caused to shed their leaves and go dormant early. Consequently, they woke up early and the buds grew and were easily killed at the first change in temperature. His practice is to cultivate late in the fall to cause the dormant period to come later. This is so; and the reason of it is the fact that the tree must rest. Peach trees, on the average, have a rest period of about six weeks. No matter what kind of weather we have during this time, the buds will not grow. After this period they will grow readily with only a small amount of encouragement. Just a little warm weather in early spring will cause these buds to swell and grow and be killed by any frost that we may have during those months. this rest period, which will cause the growth to start later in the We can regulate this somewhat by causing them to start later on spring. That is the secret of the matter of hardiness of peaches.

ORCHARD FUNGUS DISEASES.

(By F. M. Rolfs, Pathologist, Missouri State Fruit Experiment Station.)

The peach industry often suffers severely from various disease producing organisms common to the orchards of the State. The purpose of this paper is to describe a number of these diseases and suggest such remedies as have been employed successfully in holding them in check. It is often difficult to distinguish some of these diseases without the aid of a microscope, still it is well to know the symptoms of the principal ones, so as to be able to use rational methods of treatment. Doubtful cases may be referred to the pathologist of the Missouri State Fruit Experiment Station, Mountain Grove, Missouri, for identification. In sending letters of inquiry about a diseased condition of a tree, always enclose infected portions of the twigs and leaves.

Self-Boiled Lime-Sulphur Mixture—The toxic action of Bordeaux mixture on peach foliage renders it practically useless for controlling peach diseases during the growing season. The self-boiled lime-sulphur mixture, recommended by W. M. Scott, has been used by the writer during the past two years, and gives promise of becoming a valuable fungicide during the growing season. This mixture mars the appearance of the fruit, and has more or less influence on its market value if applied just before the fruit is picked.

Place seven pounds of sulphur, free from lumps, and ten pounds of fresh lime into a barrel; add six gallons of water. Some stirring is necessary while the lime slacks; if the material becomes too thick, add more water. When the lime is completely slacked add enough water to make fifty gallons. Stir thoroughly and pass through a sieve containing about twenty meshes to the inch. Considerable care must be exercised in making this mixture, for if a large quantity of lime is added the heat becomes intense, and if too much sulphur is dissolved the mixture will burn the foliage.

Lime-Sulphur Wash—The following formula is an efficient spray for scale insects, and it also has considerable value as a fungicide. Use only on dormant trees:

Lime, fresh	15 pounds
Sulphur (flowers)	15 “
Water to make	50 gallons

Place about four buckets of water in an iron kettle and heat to the boiling point. Make a thin paste of the sulphur by adding a little water. As soon as the water reaches the boiling point add the fresh lime and sulphur paste; stir constantly for ten minutes and then allow to boil fifty minutes. When the sulphur is completely dissolved, the solution takes on an amber color, and if the work is properly done, there ought not to be more than a pint or so of the residue left in the kettle.

Sulphur dissolves most readily in a concentrated mixture with lime, consequently the quantity of water used during the process of boiling ought to be kept near the minimum. However, the solution ought never to become pasty. After the cooking is completed, pass the solution on through an iron wire strainer or coarse sack into the pumping barrel or tank, and add enough hot or cold water to make fifty gallons. Stir carefully and apply at once. If allowed to cool it is apt to clog the nozzles, and if it stands over night crystals will form on the sides and bottom of the vessel. It is hard to dissolve such crystals after they have once formed. Iron pumps are best for applying this solution, since it corrodes, and in time will injure a brass pump.

Brown-rot (*Sclerotinia fructigena* (P.) Schrt.)—This is a very destructive disease. It attacks the blossoms, fruit and twigs.

If the weather conditions are favorable for the development of this organism, during the blossoming period it often attacks the flowers. Even after the petals have fallen the young fruit is sometimes injured. The infection at first produces slightly discolored spots, which spread rapidly, and soon the entire flower takes on a brownish, withered appearance. Serious attacks on the flowers are not uncommon, but usually the greatest loss results from its attacks on the ripening fruit.

The first indication of infection on the fruit is the appearance of small, brown, circular spots, which rapidly enlarge; and soon afterwards whitish tufts of conidia spores appear on the surface of the diseased area. At first the spore beds develop sparingly, but in a day or so the diseased area becomes more or less covered with a characteristic gray mold. The disease advances rapidly and the infected fruit soon becomes rotten, brownish in color and more or less shrunken. Attacked fruit either falls to the ground or gradually shrivels up and is mummied on the tree. These mummies produce conidial spores the following spring, and become centers of infection. The perfect form, perithecia, of this fungus develops from the sclerotia on the old rotten fruit, which has been allowed to remain under the trees. The fruit of some of our best varieties was completely destroyed by this fungus during the past season.

Young twigs are often severely injured by it, and frequently killed. Diseased twigs soon take on a brown, blighted appearance, as if scalded. This blighting may be due to the direct action of the fungus on the entire twig, or by simply girdling it, and thus killing the uninfected distal end by starvation. Blighted twigs are constantly associated with infected fruit.

Plums, cherries, apricots and apples are also attacked by this organism.

Treatment: No entirely satisfactory method of treating this disease is known. Still, Messrs. F. W. Faurot and T. W. Ayres, in their work at Koshkonong, Missouri, obtained very good results in controlling this organism with the self-boiled lime-sulphur mixture (10S-15L-50W). The first application was made on May 22nd. The following three applications were made at intervals of about fourteen days, while the fifth application followed the fourth in eight days, about two weeks before the fruit was picked.

In locating orchards select high, well underdrained fields. Good atmospheric drainage is also very essential. Prune the trees, so as to admit the sun light and give as free a circulation of air as possible.

Leaf-curl (*Exoascus deformans* (Berk.) Fckl.)—A common disease, but during the past season it caused very little or no trouble. This organism attacks the leaves and also injures the young shoots. It is popularly known as leaf curl. The diseased leaves become curled, crumpled, thickened and much distorted. They first turn to a pale, yellowish green color, then take on a purplish tinge, and finally the leaves become more or less covered with a velvety white fruiting coat of the fungus.

The mycelium lives from year to year in the branches, and develops with the opening of the buds. The diseased leaves sooner or later fall, consequently, in years when the fungus is abundant, it is nothing unusual to see trees almost defoliated. Premature dropping of the fruit frequently follows the loss of the foliage.

Treatment: Spray with standard Bordeaux mixture in the spring just before the buds open. A late spring application of lime-sulphur wash for scale will also control this disease.

Scab (*Cladosporium carpophilum,* Thum.)—This disease usually appears on the fruit during the last of June, or the first of July, in the form of a light brown mold, producing specks, which are scattered more or less irregularly over the upper surface of the peach. These specks gradually increase in size, several of them often blending together, forming large dark areas. During wet seasons this fungus becomes unusually active, and often forms a dark brownish coat over the entire upper surface of the fruit. The spores of this mold are developed at the tips of projecting hyphae. They germinate quickly after maturing. In general habits of growth this fungus resembles Apple Scab.

Fruit which is thus attacked while quite young does not mature properly. Badly diseased areas usually crack open. At least sixty per cent of the Elberta fruit on the station ground during the season of 1906 was ruined by this organism. The loss was even greater on a number of other varieties. The disease was especially severe on the seedling fruits.

Treatment: About four applications of the self-boiled lime-sulphur mixture (8-10-50) will control this organism. Make first application before infection occurs on the fruit, about May 15th. Repeat operation at intervals of two weeks until four applications have been made.

Die-back (*Valsa leucostoma,* Pers.)—A common disease, which attacks the twigs, limbs and trunks of the trees.

Infection occurs through the buds and wounds at any time during the growing season, but its development is most noticeable during the spring months. Alternating freezing and warm periods during late winter appear to bring about favorable conditions for the growth of this organism. It often makes considerable advancement during the warm weather in winter. The young shoots are frequently killed back from two to fifteen inches during the months of January and February. As many as three hundred diseased twigs have been counted on a single tree. Twigs of some of our leading varieties which killed duing the winter months first have a dark purplish skin, but later the skin on the infected area becomes leathery and shades into scarlet and purple, giving the twigs a characteristic appearance. The leathery-colored area finally changes to drab, and the skin becomes loose and wrinkled. Black fruiting bodies (*Cystospora rubescens*, Nitschke), about the size of a pinhead, soon appear below the epidermis on the drab-colored area. These bodies gradually enlarge and push a white dish-like cap through a transverse slit in the epidermis. The entire dead portion of the twig gradually changes to drab in color, and eventually becomes more or less dotted with black silvery capped pustules. During wet weather these black Cytospora bodies push out very fine red threads, which are composed of masses of spores. These spores are soon scattered by the rain and insects and start new points of infection.

The diseased portion of the twig soon becomes constricted, making the division between the dead and living tissue very marked. Gum pockets also form at this point, which frequently rupture the epidermis and produce a copious gum flow.

During the spring and summer months the foliage of infected twigs frequently wilts very suddenly and takes on a brown, blighted appearance. This blighting is due to the fungus girdling the stem. A gradual killing back also occurs, but the injury in such cases is not so noticeable.

Infection on well matured branches during the winter and early spring months produce oblong wounds extending up and down the stem. The epidermis covering such wounds cracks and falls away, exposing the wood. Callus soon pushes out from the edge of the injury and finally spreads over the exposed tissue. The lips of the newly formed bark, when they meet, do not unite, and often leave a split or opening through which gum exudes. Injuries of this sort produce slightly elevated oval-shaped scars on the twig or branch, and it is not uncommon to find from fifteen to twenty wounds and scars on limbs five or six feet long. In the more severe cases there is constantly an enlargement of the twig or branch at the point of injury.

On the larger limbs and trunk, especially on the southwest side of a tree, large cankers, or so-called sun scald wounds, are formed. These wounds are gradually extended, often girdling the limbs, and even the trunk of the tree is thus occasionally affected. Gumming is also constantly associated with these cankerous growths.

The foliage of limbs which die late in the spring and summer takes on an unhealthy, starved-like appearance, and wilts suddenly and shrivels. The leaves of those that will die during the following winter, in most cases, also take on a yellowish appearance and fall prematurely.

On the infected tissue of the limbs and trunk *Cytospora rubescens,* Nitschke and *Valsa leucostoma,* Pers. develop. The pustules of these two forms are constantly intermingled, except on the twigs where the peratheca seldom develop. These forms resemble each other so closely in size, shape and color that it is usually impossible to distinguish one from the other without the aid of a microscope. From our exepriments it is safe to conclude that *Cytospora rubescens,* Nitschke is the pycnidal form of *Valsa leu costoma,* Pers.

This disease also attacks the Japan plum, cherry and apricot trees.

Treatment: Cut out and burn all diseased twigs and branches. Also, remove all infected tissue from the large limbs and trunk of the trees. Cover all wounds with fresh paint.

Yellows.—A contagious disease of the tree, which causes serious loss in some of the older peach growing sections of the United States; a disease that can usually be recognized by the sickly appearance of the foliage, and the development of clusters of willowy shoots on the trunk and large limbs. Fruit on diseased limbs ripens prematurely, is usually highly colored, and the flesh is more or less specked with red dots. The flavor of such fruit is inferior, and frequently becomes quite bitter. Premature ripening and red spotted fruit are usually the first striking symptom of this disease. The duration of the disease varies considerably. Some trees die at the end of the first year, but usually they live from two to five years, and occasionally even longer.

*Treatment*s Dig out and burn immediately all infected trees, no matter how slightly affected. Make several careful inspections for the disease during the summer. Make a thorough inspection when the fruit is about ripe.

Rosette.—This disease is frequently mistaken for yellows. The symptoms of this malady usually develop during the spring, the infected trees often dying during the first year, and seldom living longer than three years.

The leaf buds of trees thus diseased usually grow into compact tufts or rosettes. This bunching of the leaves is very conspicuous and is often noticeable at a long distance. The leaves at the base of the tufts are often quite long, with inrolled margins, giving them a peculiar stiff appearance. The foliage on the tree is scant and of a yellowish green color. The peculiar willowy shoots so abundant on the trunk of the trees in yellows are as a rule not developed. Diseased trees drop their fruit early. The fruit on badly affected limbs is small, yellowish green in color, and often more or less shriveled.

Treatment: The same as for yellows; but the first inspection ought to be made during the early spring.

Frosty Mildew (*Cercosporella persica,* Sacc.)—A severe attack of this disease causes the premature falling of the leaves. It was first observed on the station grounds June 21st, and by August 20th some of the varieties had lost over sixty per cent of their foliage.

The mycelium of this fungus grows in patches on the under side of the leaves, forming a white powdery coating, which produces conidia, summer spores. Infected areas produce yellowish spots on the upper side of the leaves.

Treatment: Three applications of the self-boiled lime-sulphur mixture (8S-10L-50W) gives very good results. Make first application about July 20th. The other two applications should follow at intervals of about two weeks.

Powdery Mildew (*Sphaerotheca pannosa* (Wallr.) Lev.)—This fungus develops on the leaves and stems. On the leaves it appears as a whitish mold, and causes them to curl and become more or less distorted. The twigs are also covered by a layer of white felt-like hyphae. This layer finally becomes dark gray and produces conidia abundantly. Some of the hyphae persist on the limbs during the winter and produce the disease the followng spring.

Trees with gland-bearing leaves are invariably free from this disease. Mena and Blood Cling were the only two varieties on the station grounds which were attacked by this organism. Both varieties bear leaves destitute of glands. These trees lost over fifty per cent of their foliage before September 1st.

Treatment: Spray with the lime-sulphur wash just before the buds open in spring. As soon as leaves unfold make an application of the self-boiled lime-sulphur mixture. Repeat operation at intervals of about two weeks until at least three applications of the self-boiled mixture have been made.

Crown-Gall.—This disease forms irregular shaped galls on the roots of the trees. These galls may develop on any part of the root system, but the largest develop on the root axis. They form soft, corky or spongy growths, with a rough surface. These knots have more or less influence on the growth of the trees, consequently it is best not to plant those which show any signs of the disease.

Treatment: No successful line of treatment is known.

Root-Rot (*Clitocybe paracitica,* Wilcox).—This is a reddish, brown toadstool, measuring from two to three inches in width. It grows in dense clusters from the crown of living trees and dead stumps. The sporophores form from September to October. It also produces black subterranean rhizomorphic strands, which aid materially in spreading the disease. Wilcox states that this fungus invades the apple, peach and cherry trees.

There are also a number of other organisms which produce root-rot of fruit trees, but American plant pathologists have given these diseases very little attention.

Treatment: No satisfactory line of treatment is known.

RECENT WORK AGAINST SAN JOSE SCALE IN MISSOURI.

(By Prof. E. P. Taylor, Entomologist Missouri State Fruit Experiment Station.)

Upon the program of this meeting my assignment of subject has been a discussion of the insect enemies of the orchard and their control. The treatment of so general a subject in the limited time which I feel entitled to consume this evening seems inadvisable to attempt, and I have therefore decided to talk to you upon the subject of the San Jose scale and the status of its present occurrence and recent work against it in Missouri. You have already heard much of this most destructive insect pest through the many excellent papers given before this society by such able specialists as Miss Mary E. Murtfeldt, Dr. J. M. Stedman and others. In fact, in looking over the past reports of the Missouri Horticultural Society, I find that the insect has been so carefully described to you that I shall attempt to consider only the practical side of the question, giving the newer developments in scale treatment brought out in the San Jose scale survey experiments and demonstrative sprayings recently carried out by the Missouri State Fruit Experiment Station.

In your report for 1895, Miss Murtfeldt called your attention to the necessity of being upon the alert for this insect, which had then been recently discovered in an orchard within this State, the pest having been introduced upon imported nursery stock. In the report for 1896, Dr. Stedman again called attention to the infestation in an orchard in Central Missouri and to the steps that were being taken to eradicate the pest. The following year Dr. Stedman reported to you the discovery of the insect up to that time in ten localities of the State. In 1899, a law (Art. III, Chap. 67, Sec. 4732-33 Revised Statutes) became effective, providing that in cases orchards in the State were found infested with this pest, that the county court should issue an order to have said diseased trees dug up and burned under the direction of the manager of the Fruit Experiment Station. It soon became apparent, however, that even the destruction of those trees which were found to be infested failed in practically every case to completely eradicate the scale from the neighborhood. This was due to the fact that scattering specimens were overlooked, and the destruction of those trees showing infestation in reality did not permanently exterminate the pest from the orchard. The conclusions reached in this respect in Missouri have been those also of other states, where the pest has been prevalent for even a much longer period. We are now forced to conclude that the practical solution of the San Jose scale problem in Missouri must rest primarily upon three essentials: *First,* to minimize the dissemination and introduction of the pest by strict and compulsory inspection of all nurseries of the State and by making it unlawful by statute to ship nursery stock into the State without its bearing certification of having passed official inspection or approved insecticide treatment before entering; *second,* a law making spraying or treatment by the owners of infested orchards compulsory where it can be shown that they are, on account of failure to apply known remedies of control, maintaining orchards so badly infested that they are appreciably infesting the orchards of their neighbors; and *third,* the adoption by orchardists, where the scale has been introduced, of a rational system of spraying to hold the insect in check. It is a lamentable fact at the present time in Missouri that our regulation of nursery shipments, while they wisely provide against shipping into the State of nursery stock not covered by a proper certificate, at the same time permit the shipping without inspection of stock grown in Missouri to any point within the State. (Session Acts 1901, p. 134.) There is, it is true, provision made for the inspection of stock upon the request of the nurseryman, but this has not proven a proper safeguard against the distribution within the

State of infested nursery stock by nurserymen who have not *requested* such inspection. The present arrangements for nursery work are in this respect working more for the protection of tree planters of other states than for those in Missouri.

Present day methods have shown that the San Jose scale can be successfully controlled in orchards by spraying, and the Fruit Experiment Station has been working along lines of recommendation and instruction in methods of combating the pest. Though it is probably the most serious of all insect pests of fruit trees when nothing is done to check its work, with proper spraying it may be controlled in orchards as cheaply and more effectively than some of the other more common orchard insects. Without depreciating its pernicious effects upon infested trees, it should be looked upon by the orchardist in the same light as many other noxious insects requiring spraying to protect the tree and its fruit.

Experiments of Insecticides.—Besides the extensive spraying demonstrations mentioned below, experiments have been conducted upon several infested orchards, using only the most common formulas and kinds of sprays now in use against this pest. These experiments included the use of the following:

(1) Home-made lime-sulphur washes.
(2) Commercial lime-sulphur washes.
(3) Home-made oil emulsions.
(4) Commercial oil emulsions.

Much has been written of the various sprays recommended for this insect. The details of making the lime-sulphur washes have been gone into most carefully by experiment stations, and there are so many fruit growers throughout the country that have for many years been successfully using this spray that further experiments proving its great value seem almost unnecessary. The introduction, more recently, of commercial lime-sulphur solutions, making it possible for orchardists to purchase ready-made lime-sulphur solutions which have only to be diluted with cold water before using, has simplified the spraying operation and furnished a material which is valuable and which is to be recommended under certain conditions to the use of orchard owners.

For several years there have been upon the market commercial oil sprays which have been tested by orchardists and experiment stations. It has long been known that oil sprays are valuable sprays for the San Jose scale, but their adoption into use by orchardists has been retarded from the danger of injury to tree by the use of the oils in their pure forms. Kerosene emulsion is one of our most valuable contact sprays, but on account of its difficulty of preparation by the average orchardist, it has not been usually adopted. On account of its being made with the lighter oils, it evaporated so rapidly from the bark of the trees that in order to make it penetrate the scale covering it was necessary to use a high and costly percentage of oil. Working along this line, the commercial miscible oil emulsions were evolved. These are sold in concentrate form, and require only dilution with cold water to make them ready for use. They are convenient and pleasant to use, and that they are very effective when used thoroughly at the right strength and at the correct time, cannot be disputed. Their cost, however, is considerable, and they must be used with greater care to prevent injury to the trees. Prof. Charles L. Penny, formerly of the Delaware Experiment Station, and now of the Pennsylvania Station, made a careful chemical study of the manufacture of concentrated miscible oils, laying down a formula which any orchardist could follow, enabling him thereby to prepare his own oil emulsion by the use, principally, of the heavy, crude oils everywhere available. The making of emulsions using the heavier oils as a basis at a greatly reduced cost promises to be a long and important step in the direction of practical scale remedies. The experiments carried out were for the purpose of bringing into comparison the new forms of oil emulsion sprays with the standard lime-sulphur sprays, as well as a comparison of the commercial mixtures with those which the fruit grower might be able to mix.

The results of these experiments will soon be available through a bulletin of this station. They have shown that the lime-sulphur wash is still the cheapest and most satisfactory insecticide against San Jose scale from the majority of standpoints, but that there are many excellent features in connection with the use of oil emulsion. There are cases where commercial oil sprays are to be preferred, and their sale has in many cases caused orchardists to undertake spraying for this pest who would otherwise have allowed their orchards to have become encrusted and killed.

The lime-sulphur wash, either as prepared by the orchardist or bought ready for use, the oil emulsions as made by him or bought from a reliable oil emulsion manufacturer, are available to the one with scale infested trees. These sprays must be applied in the right manner and season and with proper precaution to prevent injury to the trees. The spray best adapted to any particular case will depend upon the size of orchard, nearness to source of material, kind of spraying equipment and other local conditions. There is no excuse for the sacrificing of orchards to the ravages of San Jose scale with the present knowledge of its control available.

San Jose Scale Spraying Demonstrations.—One of the methods of the station in furnishing practical knowledge of its control has been in conducting public spraying demonstrations in sections where the pest is present and where the fruit growers have not yet adopted successful spraying methods. Before these demonstrations could be held an inspection of as many fruit localities as was possible was made, in order that the demonstrations might be undertaken in places where they might prove of greatest benefit. The insect being an introduced pest, there are many localities of the State probably harboring it and suffering the loss of orchard trees without a knowledge of the cause. Printed notices were sent to about 800 of the leading city and county papers in the State in which a brief description of the pest was given, and requesting that samples of twigs from scale infested trees be sent to the Entomologist of the State Fruit Experiment Station at Mountain Grove for examination. From responses to these newspaper notices, from inspections made and from other sources a total of 28 distinct localities have been reported infested with this pest. These represent widely separated counties in every geographic quarter of the State. The report of infestation with this insect has been verified with inspection of samples sent for identification or from samples personally collected in 22 of the 28 localities reported. The remaining six localities are reported infested upon responsible authority and will be visited the coming summer and fall. The 28 infested localities are situated in 23 different counties of the State, and vary in extent from counties where but a single infested orchard in the county is known to a much larger territory. In one instance the infestation has spread to include the greater per cent of the fruit plantings if the county.

Public spraying demonstrations have been given since October 15, 1907, in eleven separate fruit sections where the infestation was most serious. These were held in eight different counties of the State. Personal inspection trips have been made into six other localities where the demonstrations were not considered necessary, but where instruction was given in the mode of preparing and applying sprays for the pest. The balance of the infested localities will be given inspection this summer or fall by demonstration, if necessary, as soon as the shedding of the leaves from the trees will permit. In response to the request for samples of twigs infested with San Jose scale, a large number of specimens of related scale insects have been received, such as oystershell bark-louse, scurfy bark-louse, Forbes and Putnam scales, or other allied species which are native and quite generally distributed over the State.

In a number of the places it was found that progressive orchardists had taken up the spraying against San Jose scale, and were so successfully holding it in check that it did not seem to be causing any concern among the orchard owners, nor was it apparently spreading to other premises in the neighborhood enough to cause alarm. In such places it was not considered necessary to undertake demonstrative work. Some places were found where the pest had been but recently introduced, and in others growers were found to have had but partially successful results from spraying, due to improper methods, materials, apparatus or other causes. In such localities the public spraying demonstrations were held. Orchards centrally located, and where the infestation and conditions made them favorable as object lessons, were selected. Spray pumps, apparatus and a portion, at least, of the material were shipped by the Fruit Experiment Station to the selected orchards. Press notices in local papers and hand bills were employed to advertise throughout the community the date, place and object of the demonstration, and usually through the agency of some local horticultural society or public spirited citizens interest was aroused. Wherever advisable evening meetings were arranged and the subject discussed before the fruit growers, sometimes illustrating with stereopticon slides. At the spraying demonstration the material was prepared and applied under the supervision of the entomologist of the station and instruction given in a practical way. Over a thousand fruit growers during the past fall, winter and spring attended these free practical demonstrations or evening lectures, held in different parts of the State.

The outcome of these operations has been to stimulate fruit growers to increased effort along all spraying lines. In some places growers had doubted that it was practical to control San Jose scale by spraying. Under this belief no spraying machinery had been purchased, and as the infestation spread or became more serious in their orchards the worst infested trees were dug up and destroyed. It soon became apparent that such a procedure would soon result in the loss of their whole orchard, and, following the assurance obtained by witnessing the outcome of a practical spraying demonstration, they have purchased spraying apparatus, and are now including scale spraying as a regular orchard practice. That these public demonstrations are bringing good results is already plain to be seen. People have read much of the San Jose scale, but have needed to have it pointed out to them upon trees actually infested and to be able to witness how it is controlled by spraying. In a single township in St. Louis county, as a result of these spraying demonstrations and the influence of a few progressive and well informed men, 20,000 infested fruit trees and shrubs were sprayed by orchardists the past winter with most excellent results, and this in a community where practically nothing had previously been done to check the spreading of the scale and the destruction of infested fruit trees which was becoming more serious each year.

These public spraying demonstrations will be continued by this station this fall as soon as the trees have become dormant, at which time the spraying must be done. It is also desirable, in order that these practical educational measures may be extended into new territories where the scale is now present, that a close co-operation between the fruit growers of the State and the Fruit Experiment Station at Mountain Grove be maintained, and that samples of all suspicious looking scale insects be forwarded to the entomologist of the station for examination and determination, in order that assistance may be given.

It is especially important that the fruit growers lose no time in the matter of checking this pest. Its destruction by spraying may mean not only the saving of the infested orchard from ultimate ruin, but it will check the spread of the insect into new localities of the State where at present the insect has not been introduced. This is extremely important and should be considered by the fruit growers within the State upon whose premises the pest is now present. Although Missouri holds third rank in number of fruit trees growing in the State, the per cent of orchards within her boundaries which are now infested with San Jose scale is not great. So far as is now known, the pest has been introduced into only 23 out of the 115 counties of the State, representing only one-fifth ($\frac{1}{5}$) infested, and in some counties the infestation is limited to only a single isolated family orchard of a few trees. In some of the principal fruit growing districts of the State the pest is unknown except from published accounts of the insect which the orchardists have read in fruit papers, experiment station bulletins or horticultural society proceedings. The 23 counties already known to harbor infested orchards are so widely distributed over the State that, unless spraying measures are adopted and the pest kept under control in them, they may act as centers of dispersion for the pest, which will hasten the extension of the infestation into many quarters now free from its ravages.

HARDY PEACHES.

(By R. M. Hitt, of Koshkonong, Member State Board of Horticulture.)

The hardiness of any variety of peaches depends largely upon the care which the trees have received and the location of the orchard. While the elevation of the land may be very high, the surrounding hills and valleys may lay in just the proper position to cause cold air waves in the spring to pass directly over the orchard.

The Elberta, which is grown very extensively in the Koshkonong district, is generally considered a hardy variety, but the hardiness of the Elberta depends largely upon the treatment of the orchard. You cannot expect a neglected tree to produce hardy buds or fancy fruit any more than you can a neglected corn field to produce large, solid ears of corn.

I have with me some specimens of peaches grown on water sprouts. The tree from which these sprouts came is located on low ground, and these sprouts are the only parts of the tree to bear this year. The water sprouts had made a vigorous growth last summer and apparently did not stop growing until frost in the fall, while the balance of the tree lost its leaves early and stopped growing long before frost.

Now this would indicate that, inasmuch as these sprouts carried their buds successfully through the winter, a late growth of trees would, of course, strengthen the vitality of the buds. Or, in other words, the trees should not go into winter quarters prematurely or before the winter season.

This condition can be produced or the trees can be kept growing up until the first frost in the fall by pruning, cultivation, fertilizing and, possibly, by spraying.

It is claimed that seedlings are more hardy than budded varieties. My experience will not bear out this theory. Hardiness is more a matter of locality, season, soil and treatment than an inbred quality of the trees.

We thought we had a hardy variety in the Picquett's Late because it proved so one year, bearing when everything else failed; but this condition did not continue so, and I am led to believe that the selection of leaf buds for propagation from trees that have shown signs of hardiness one year will not necessarily produce trees of like hardiness unless the trees produced are planted in like soil and location and given similar treatment as the tree from which they are propagated.

In conclusion, I will say that the conditions are changed so every year that it is hard to state anything as a fact. It is all theory. We were always taught to plant our peaches on north slopes. That theory held good last year, but this year the late frost caught the peaches on the north slope, and we find the bulk of our crop on the south side of the hill.

DISCUSSION.

Mr. Candler.—Speaking of north slopes, was it probable that the south slope, not having any fruit on it last year, grew a more vigorous growth of wood while the other side was growing fruit?

Mr. Hitt.—There may be something in that theory, but what about the trees on top of the hill? They bear every year.

Mr. Howard.—Those peaches you showed us you say were grown low down close to the ground on water sprouts and the trees were grown on low ground?

Mr. Hitt.—Yes, they were grown on water sprouts.

Mr. Howard.—Perhaps the reason there were peaches on the water sprouts is that these sprouts grew later in the summer, and, consequently, wake up later in the spring.

Mr. Hitt.—That brings up again the theories of Mr. Paynter of cultivating late in the fall in order to induce a late growth. If you induce a late growth, the leaves will be that much longer on the trees and the buds will be later in coming out in the spring. Late frosts are not then much danger, but early frosts in the fall may do damage.

Mr. Dunlap.—I have not heard anything about spraying peaches. I was wondering why foliage drops and growth stops so early. Is it from the same cause that apples lose their leaves? In neglected apple orchards the leaves drop first, while with the trees that are cared for the leaves hang on until frost. We have tried spraying with Bordeaux mixture, and the leaves will hang on until late in the fall. I was wondering if peach foliage was not attacked by a fungus disease just as the apple foliage, and if spraying would not also cause the leaves of the peach to hang on longer. I would like to know why you do not spray your peach trees. They do it in Michigan. Why not here? I am an ignoramus on peaches because I don't grow peaches for market.

Mr. Stark.—Hardiness of peach buds may not be so essential in the south part of the State as in the north part. Mr. Riehl of Alton, Ill., has one variety which has withstood temperatures of 26 degrees below zero. As you may recall, A. W. Pool of Ozark, Ark., advises thorough and continual cultivation and advocates fertilizing with the shears. He believes in severe and heavy pruning to keep up a vigorous growth and to make the trees hold their fruit buds longer.

Mr. Rolfs.—It is true that there are numerous fungus diseases which attack peach foilage. For instance, shothole at the Station was kept in check by spraying with self-boiled lime-sulphur mixture. This also held the foliage on until late in the year. Those sprayed with Bordeaux did not hold their leaves so long. Fungus diseases do have a part in the shedding of foliage, and also appear in the weakening of buds.

Mr. Hitt.—We noticed the same thing at Koshkonong last year. The sprayed trees held leaves longer. We were experimenting with sprays for the brown rot during the season until two weeks before ripening. Bordeaux injured the foliage when applied. I regard lime and sulphur as an excellent spray, and very beneficial results in using it on peaches have been obtained. The only thing against it is that it spoils the appearance of the fruit. Sticks to the fuzz and looks very bad. We had to brush off each peach, but the spray checked the rot.

Mr. Dunlap.—Was it applied before the buds started?

Mr. Hitt.—It was applied up to within two weeks of ripening, but the trees were sprayed with lime much later.

Mr. Rolfs.—Better results may come from this spraying if sulphur is added. This may be made easily. Place seven pounds of sulphur, free from lumps, and ten pounds of fresh lime into a barrel, then add six gallons of water. Some stirring is necessary while the lime slacks; if the material becomes too thick, add more water. When the lime is completely slacked add enough water to make fifty gallons. Stir thoroughly and pass through a sieve containing about twenty meshes to the inch. This spray is much better than Bordeaux during the growing season. It should not, however, be used near the ripening period, as it tends to disfigure the fruit. We used it this spring with splendid results.

Mr. Hitt.—The lime and sulphur spray, I think, is an excellent one. It is easily made and is easy to apply. However, it spoils the appearance of the fruit, and you can hardly brush off the lime from the peach. Applying it late makes necessary some method for cleaning the fruit.

Dr. Evans.—Returning to the spraying at Koshkonong, I would like to ask how the fruit is on those trees this year that held their leaves late through spraying.

Mr. Hitt.—Very little fruit on them this year, but you find that condition on the unsprayed trees.

Dr. Howard.—I should like to add that the mere retaining of the leaves on the tree is not sufficient to insure continual growth on the part of the buds. The leaves will sometimes help by staying on late, but what helps more is the roots. Here we come again to the subjects of late cultivation and fertilizers.

Mr. Rolfs.—In New York the growers are afraid to use fertilizer on account of getting new growth late. They are not troubled with early growth in the spring.

Dr. Howard.—We are troubled with a tendency to grow in late winter if the trees went dormant early the previous fall.

Mr. Paynter.—There are a good many peach growers here in this meeting. I would like to ask if the results have been worse when the peach trees retained vigorous growth than when they did not. I should like to know from practical experience just what the results have been. My observations have led me to believe that we quit cultivating too early. It is a long time from August until April. We don't get any winter until Christmas or January. Some of our trees have been maturing in August, and, consequently, have gone through their cycle of maturity, and are ready during the first warm days to begin growth. These warm days come on in February and March, and then any little cold spell gets them. It is not a question of the degree of cold; it is a question of the condition of buds when cold comes. We get ten degrees below zero in winter and it does not affect the buds, but let the thermometer drop below freezing in the spring months and there goes your peach crop.

You have been told that there is a certain period in which the buds are inactive. Just as soon as the tree has matured its crop it begins immediately to prepare for the next crop as fast as it can. It gets shut of its leaves and goes into the resting stage some time in August. Now in the course of seventy or eighty days it will be ready to begin life again. If we can prolong the growing stage until the winter weather sets in, we can do much toward insuring the buds against the cold. If we can hold the foliage on the trees in the late summer by cultivating, spraying or fertilizing, we have done much in prolonging the resting period. If my Elbertas will yield me one and one-half or two baskets more by spraying, I shall spray. If I can get any more by spraying or cultivating, I shall spray or cultivate. But I think there is a happy medium, and I shall attempt to maintain that medium. Experience is the only way to learn, and whether it be the experience of myself or my neighbor, we must take advantage of this condition of things.

President Dutcher.—I had a few peaches when I left home, but I am not sure of finding them when I get back. Next September I wish to cut out the center of the trees. Would like to cut out some high center limbs. I would like to know what will be the effect of heading back like this. Will this help in retaining the buds in the spring?

Mr. Elliott.—That probably will help in making buds hardier. Trees should be pruned when dormant. They should not be touched with the pruning shears during the growing season. January, and not September, would be a good time to do this work that Mr. Dutcher speaks of. It could be done then with less injury to the trees.

President Dutcher.—Speaking about the lime-sulphur-spray, I find it a good plan to have it in the form of dust, and use on everything that grows in the way of cultivated fruits, especially the peach. I keep it all through the fall and use at regular intervals. Trees keep their leaves all through the fall when the trees of my neighbors have all lost their leaves. I do not know whether this is the reason or not, for I do give later cultivation than most. I nearly always cultivate until the 20th of September. Mr. Hale of Georgia and Connecticut gives late and clean cultivation. He secures a heavy growth of thick covering over the ground as late as he can conveniently do so. Later he goes over the entire ground with a roller to mash this growth down, and thereby makes a mat over the entire ground just before freezing. He tries in this way to hold the frost in the ground and thus keep the trees from growing too early in the spring.

Mr. Stark.—I have been in Mr. Hale's orchard. I inquired if he fertilized. Said he no longer followed general fertilizing. He observed the needs of individual trees, and treated them accordingly to keep up vigor in a good deal like the doctor prescribes for his patients. I would like to ask Mr. Paynter if he ever used nitrate of soda to keep the foliage.

Mr. Paynter.—No, sir.

Mr. Stark.—One hundred to two hundred pounds of nitrate of soda per acre enables one to keep the foliage on the tree until very late, as late as you desire.

Mr. Wilson.—I would like to ask for information how to procure nitrate of soda in small quantities.

Mr. Stark.—Car load lots are cheapest. In ton lots it can be secured quite cheaply. Can be had from Whitelaw Bros., St. Louis. They will sell direct to anyone; you do not have to order through a dealer.

Mr. Dutcher.—I have had some experience in getting this. It is better if several go together and get a ton or half ton and divide.

Mr. Stark.—The nitrate of soda people send out quite a bulletin, which they have mailed to the fruit growers. We have used this bulletin in Louisiana.

President Dutcher.—Will you kindly tell us the name of the people who publish the bulletin?

Mr. Stark.—Wm. S. Meyers, Nitrate Propaganda, Broadway, New York.

LARGE VS. SMALL ORCHARDS.

(By Professor C. H. Dutcher, Warrensburg.)

Large and small are relative terms. What is large to one man is small to another. Large farms are incident to the settlement of a new country by men of wealth. Men occasionally leave their farms, even now, move to town, and buy an acre or so of ground, at least, two or three lots, 50 by 144, and would not think of living on less. But a few years pass, and a single lot is enough for them. As the country becomes older, large farms are gradualy cut up into smaller ones. Large orchards need not expect to be an exception to the rule.

Fruit growers have not been immune from this itching for a large orchard—a mistake it may be—but who is to decide, and what shall the standard be? The small or family orchard was first, and the commercial orchard came later. In early times, before diseases and insects became prevalent, orcharding was easy, but not so now. At no time can we afford to put out more trees than we can properly cultivate, feed, prune and spray.

But this is no new question. As early as 1892 small orchards, even for commercial purposes, had their advocates. They said large orchards can not receive proper care. In reply, the Olden Fruit Farm was cited as one that was better cared for than any small orchard in the land, "from the planting of the trees to the selling of the fruit," and this orchard had, at that time, nearly two hundred thousand trees. This admirer of the large orchard regretted that he had not set out forty acres instead of eight, and thought that the orchard of nearly two hundred thousand trees was ideal, and wished he owned one. The next report, the one for 1893, contains this advice: "No one should set out an orchard unless he is sure he can give it both manure and mellow cultivation. There will be more profit in the small and perfect one than in the one extended and neglected." Another said, "There are times when only those who grow apples on a large scale can make any money." Neither of these owned a large orchard, or had any interest in one even as a part owner that I ever heard of.

Prof. Taft said at the December meeting, 1906: "Remember ... that while 20 acres, well cared for, may give a good income, the same care extended over 100 acres may result in failure." At another time he volunteered this advice: "Put in small orchards, or at least no larger than can be cared for, and then see that they have proper attention." That is, I am sure, the solution of the problem. One's ability and resources to properly care for an orchard—to give the proper cultivation, supply the necessary food, do the needed pruning and do thorough spraying—should be the measure of the size of one's orchard, and not the number of acres or the number of trees. If then a fruit company possesses the ability to give such care to two hundred or even five hundred thousand trees and put the crop on the market, such an orchard is not too large. On the contrary, if a man has the ability to thus care for only five acres and sets twenty, his orchard is too large. Ability *to do,* and not *to count,* should be the criterion.

This has been the position of our fruit growers for the last sixteen years I know. Since the 1892 report I find nothing advocating the large orchard per se. Every report is well filled with advice and exhortation to thoroughness in everything that has been found necessary to the proper care of an orchard. That one who can care for only ten acres of orchard should not set out fifty is so axiomatic, it seems almost an insult to our intelligence to mention it.

Having heard from Prof. Taft, let us hear from Prof. Lazenby. He says: "To the horticulturists of the West there is a peculiar fascination in mere magnitude;" shows how few individuals or corporations there are who can handle "orchards whose boundaries are estimated by miles," and says: "I am satisfied that....... orchards and vineyards of moderate size .... yield a better net profit than the large orchard." We admit the great West has been much inclined to big things in all lines of farming, but a change is rapidly coming. It is high time that the plantation and the ranch for farming purposes, in many sections of the country, were divided up among the sons and sons-in-law who will resort to more intensive farming. As I said on a former occasion, so say I now, "It is high time we were learning something from our good housewives and their hens. It is not the large chicken ranch that has made the hen such a valuable asset in Missouri and Arkansas, and never will be. Fewer acres and more work—especially intelligent work—whether in raising corn, cotton or orchards, are what the age demands."

One more witness and I am through. Prof. Gould said at the 1906 (December) meeting: "The repeated confession of many growers that 'I had so much to do that I couldn't cultivate or couldn't spray,' or couldn't do this or that or something else that their ideals demand, is only another way of saying that many orchards are too large." Mr. Gould closed the paragraph from which the above is taken thus: "I am fully convinced that the solution of the problem of more successful fruit growing lies in the adoption of more intensive methods of culture, and the greater profitableness thereof in closer union and co-operation among the fruit growers." Nothing truer in the entire business. *Greater union and co-operation* in securing boxes and barrels, in picking, sorting, packing and putting on the market, is absolutely necessary among small orchardists. Only corporations can handle a large crop as an individual. Corporation or co-operation, which shall it be? One you must have.

DISCUSSION.

Mr. Dunlap.—I appreciate the paper just read by Mr. Dutcher very much and believe it sounds the right note. If a man is capable of handling a large orchard, the large orchard is all right. But often they are limited in their capital and in their ability and undertake more than they can carry out properly. One man can take a large orchard and make a success of it, and another man would make a failure with it. This with the same capital. Again each man might have the capabilities, and still one might be limited in his capital to such an extent that he could not carry on the work of the orchard. One must have working capital to carry on the business. We find men frequently not able to buy outfits, tools and hire men to run the orchards properly. These men must trust to Providence for the results, and very often they come up without an apple crop and the orchard business gets a black eye.

Mr. Todd.—I agree with Mr. Dutcher on many points. One point which I believe he left out was regarding acreage. I believe the most successful man in growing fruit is the one who has got enough money in the business to make it of interest to him. I do not mean by this that he is overloaded, of course, but he should have enough to hold an interest for him. The commercial grower will be the successful apple grower in the United States. I know of several small orchards in my vicinity which have been neglected simply because the farmers did not have enough invested in them to make them have an interest in the work. A successful man in any business is the man who has sufficient invested to make him look to the outcome of the business. I do not mean by this to condemn small orchards. But I mean that small orchards should have more invested in them in the way of pruning, cultivation, spraying, etc. A small acreage may yield good returns if properly cared for. I believe that every farmer should have his own home orchard just the same as he has his own home garden.

Mr. Wilson.—I think location affects co-operation to a great extent. The growers around a large city do not need to co-operate so much as the grower farther away. He is near enough to care for the marketing himself and to see that he gets a square deal. I think that co-operation for the purpose of marketing to the best advantage is one of the greatest reasons for the fruit growers forming associations.

By a Member.—How many acres have you planted, Senator Dunlap?

Senator Dunlap.—I do not think it would be safe for me to answer this question. I will tell you of a few phases of the apple business as I have found it in Illinois with regard to large commercial orchards. I live in Champaign county, Ill., and have 150 acres of orchard there. I am the only commercial grower in the county; in fact, have the only large orchard in that county with the exception of one of ten acres. All the other orchards are small. The commercial fruit growing belt is 50 to 100 miles farther south. In our commercial fruit section planting began in the early nineties. They planted good varieties, but of course, made some mistakes. But as a rule the varieties were generally good. At bearing age, when the owners had to invest in spraying outfits and other tools, many of the growers sold their orchards rather than put more money into the business. I became interested and invested considerable there. Now I am interested in quite a number of orchards. From my experience, it is my opinion that if the fruit growers had organizations with central managers, so that they could buy and sell in large quantities, they might run on the most economical plan of production and sell on the best plan possible. There is no doubt in my mind that a good manager will pay for himself and make good money for the members of an association.

Now what is the most economical size of an orchard to pay best returns? This question may be answered by a reference to a man in any business. It also depends on how a man is going into the business. He may wish to live on the place and help in the work himself—he and his family. Or he may wish to employ a foreman. If the latter is the case, he must plan to give him work all the year around. You must furnish your foreman enough work to keep him busy all through the year. You must also figure to make a profit for yourself after this foreman is paid. But we find that a 40-acre orchard of 12 or 15-year-old trees will not furnish work to make it profitable to the owner, but a 60 or 80-acre orchard can probably be made to pay good returns and still pay the foreman. If I were going on the farm myself in Southern Illinois, I would prefer about an equal amount of apple orchard and land to farm or for live stock purposes. I think the average orchardist should carry on both. There should be enough hogs to take care of the waste on the place, and a person should raise hay and grain enough to keep his team. Beginning in the spring, before bloom comes, spray, disk thoroughly, then spray again. Then go in and disk about every two or three weeks. Then spray third time and disk again until middle of July. Investigate for borers if you have not done so before. There will be more leisure now than any other time. Then comes packing season, and the foreman is kept busy until that is over. Soon as packing is done, begin trimming and take the rest of the year to go over the orchard thoroughly. During the spring one might need to employ an extra man, but not very often. This is about the best one can do and make fair profit.

Last year I bought a 750-acre farm with 200 acres of bearing apple orchard, mostly of Jonathan, Ben Davis and Gano in equal quantity. They were all planted in blocks. Found an average of three trees vacancy in an acre. I replanted with Grimes to secure cross pollination. Planted 150 acres more of orchard. I thought I had enough Ben Davis, so planted Jonathan, Grimes and summer varieties in equal quantities, four rows of each. I shall plant about as much more next year of the same varieties. I place the trees about 30 feet apart and do not use any fillers. In the last seven years have been very successful. Four full crops, two partial crops which about paid expenses, and one failure, have come to us in that time.

BEST COMMERCIAL VARIETIES OF STRAWBERRIES.

(By Mrs. A. Z. Moore.)

Our fruit comes into bearing here after the Neosho fruit is gone, and gives us a very good market. For this reason we cannot plant a variety that bears ahead of the season. At the same time we must choose for commercial purposes a strawberry that will ship well, as it must go to the northern markets. Taking everything into consideration, we have found the Aroma to be one of the best berries for all our purposes. It grows to a good size, has good flavor and ships well. The berries ripen evenly and the season is of good length. Here at Mountain Grove we have found the Aroma to be a good bearer year after year, and in point of actual money returns, it has given us more than any other one variety. Our Aroma berries sold for $3.00 per crate, when the Gandy and other varieties were selling at from $2.50 to $2.75 in the same lot.

DISCUSSION.

Col. Evans.—I grow the Aroma both for market use and for home use, and find it very satisfactory for both cases. In fact, I might say that I like it better than any other for home use. Nothing finer than a dish of Aroma berries. At the same time, I have made more money out of the Aroma than any other variety.

HOW CAN FARMERS BE INFLUENCED TO BEAUTIFY THEIR HOMES.

(By Professor J. C. Whitten.)

In planning to beautify a farm home, the first point is to get rid of the impression that it costs a great deal of money to make a country home beautiful. Oftentimes a country home can be made very attractive by a little personal trouble with no large expenditure or care. One of the first things to do is to clear up the place. Too often about country homes there is so much room, fresh air and so much large out-of-doors that the wood-pile, the machinery and other things are left scattered about the place. A little order in arranging the front yard, and back yard as well, can get rid of this confusion. Once the grounds are cleaned up it remains only for a little system to be inaugurated in keeping things in place to have the grounds remain clean. So far as landscape planting is concerned, most country homes are so situated as to have views of natural landscapes that are in themselves beautiful. Sometimes it is necessary only to clear out a few trees, opening up vistas, to give views from the windows and porches to distant hillsides or water-courses, in order to secure beautiful landscape effects. In the heart of the Ozarks, for example, where this meeting is being held, one has only to glance out of these windows to the wooded hillsides across the gorges and ravines and river valleys to see nature in all its beauty even without much ornamental planting. In planting shade trees immediately about the house it is well to group them in such a way that one may see out between the groups over the surrounding landscape. Shade trees should be placed so as to afford needed shade. If a porch is heated by the afternoon sun, a shade tree may be so placed as to protect it from this excessive sunlight. Usually it may be so placed, or else pruned in such a manner, however, as not to cut out distant views.

Sometimes vines and ornamental shrubbery are desirable about the farm home. In selecting the things to plant often there is nothing better than wild species which grow in the surrounding woodland. It is a common mistake among many to refrain from ornamental planting because they think they must pay exorbitant prices for rare shade trees or rare exotic shrubs, when, as a matter of fact, perhaps their own native species are far better suited

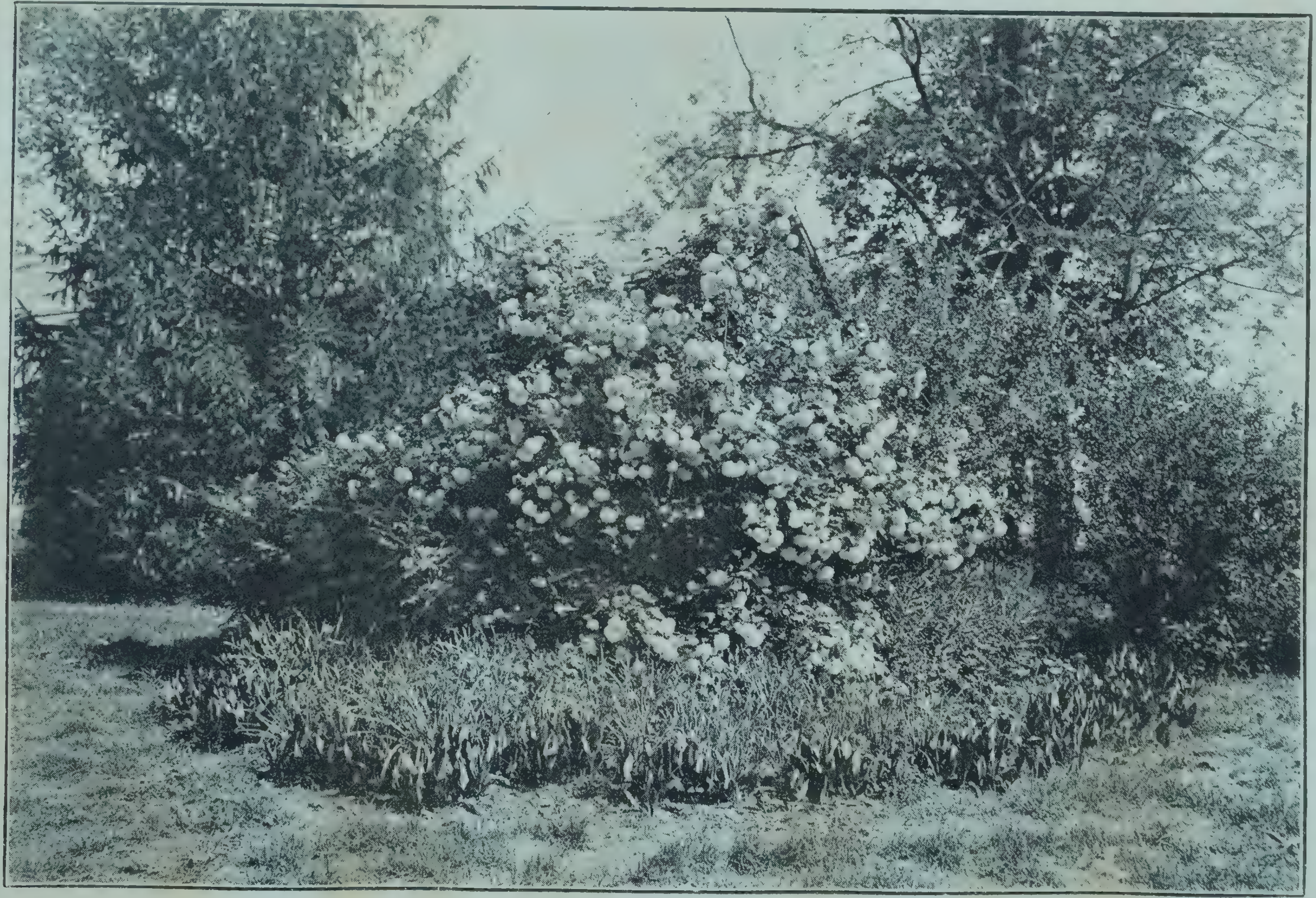


Figure 1. How an unsightly cottage may be made beautiful by massing shrubbery about it. The large flowering shrub is a snowball and in front of it are lily of the valley.

to the purpose. The trees native to one's own locality are usually the best ones to plant. The same is true of native shrubs and vines. Native species are acclimatized; they are at home and properly adapted; they are always in keeping with the natural surroundings. A vigorous native shrub, vine or tree possesses more beauty than any rare tender exotic which, growing out of its latitude, can barely be kept half alive. Some of the handsome native shrubs of Missouri may be mentioned as follows: The redbud, dogwood, wild haw, wild crab-apple, elderberry, Hibiscus, toothache berry, wild plum, bladder-nut, Euonymus, and even the despised buckbush. Among vines or climbers should be mentioned the trumpet-creeper, the native five-leafed ivy or Ampelopsis, the cross-vine, the Man-of-the-Earth or native morning-glory, the moonseed, and many others. Some of these vines cling to the wall while others are twiners, which need a trellis or some support over which to grow. Those which cling tightly to walls should not be planted except on stone houses or brick houses, as they are likely to injure woodwork.

The best location for the vines is to twine them over the porches or to plant along a back fence, as screens for unsightly out-buildings. Shrubs may be massed about the house or grouped so as to screen away the region of the wood-pile or other unsightly parts of the premises.

In discussing planting about the country home, mention should also be made about the desirability of planting about our school houses. One of the most deplorable sights is our average country school house, with its barren surroundings, devoid of planting. A little work would make almost any country school grounds a thing of beauty. It would afford opportunity to give the children training in planting and decorating the grounds. A little work expended in this direction frequently would be felt in the way of beneficial influences throughout the entire neighborhood. In planting about a school building care should be taken not to obstruct the play ground. Trees may be grouped about the borders, in the rear or in the angles of the grounds. Shrubs can be planted beneath them, at the outer border or in the angles, so as to give a frame-work to the play ground. Masses can be so arranged as to screen away fuel buildings or other unsightly objects. Frequently the bare corners of the building can be softened by growths of low shrubs, massed at the corners or in the angles of the steps.

DISCUSSION.

Mr. Dutcher—Would you advise planting climbing roses instead of the creeper?

Dr. Whitten—Roses make very beautiful window plants, especially during flowering time. The odor from the blossoms is not disagreeable, and they can usually be very easily grown.

Mr. Stark—Your reference to public school planting brings up to my mind what has been done in Louisiana, Mo., through the public schools being brought to an intelligent understanding of the planting of the grounds. This work was started in the public schools, and our firm encouraged it by giving away as prizes plants and shrubbery, and giving them instructions on home planting. The interest has increased, and not only are the home grounds improved, but also the public school grounds have been benefited immensely, and every spring there is an increasing demand for trees and flowering shrubs.

Mrs. Moore—I have heard Dr. Whitten, and I think his suggestion that we have gardening contests among the children is a good one, and will go far toward making Mountain Grove a better looking town. It is just what we need here, and just what the people desire.

Dr. Whitten—I am sure if these contests were once started, it would be an easy matter to interest local nurserymen in the project of supplying trees. Then the business men would be glad to assist you in the work also, I am quite sure.

Mr. Dutcher—I think this is a good work that we might all go into and encourage and assist the children. The instruction in plant life itself to the child is worth a great deal to the average child. It is a subject we cannot well overlook.

"UPS AND DOWNS" OF APPLE GROWERS.

(By Mrs. E. Hetherington Hodge.)

Apple growing is a story in two parts: Part one consists of four chapters—namely, selection of location, selection of varieties to be planted, selection of the nursery stock, and planting. Part two consists of six chapters: Cultivation, fertilization, pruning, spraying, marketing.

It is quite astonishing how few outside of those engaged in

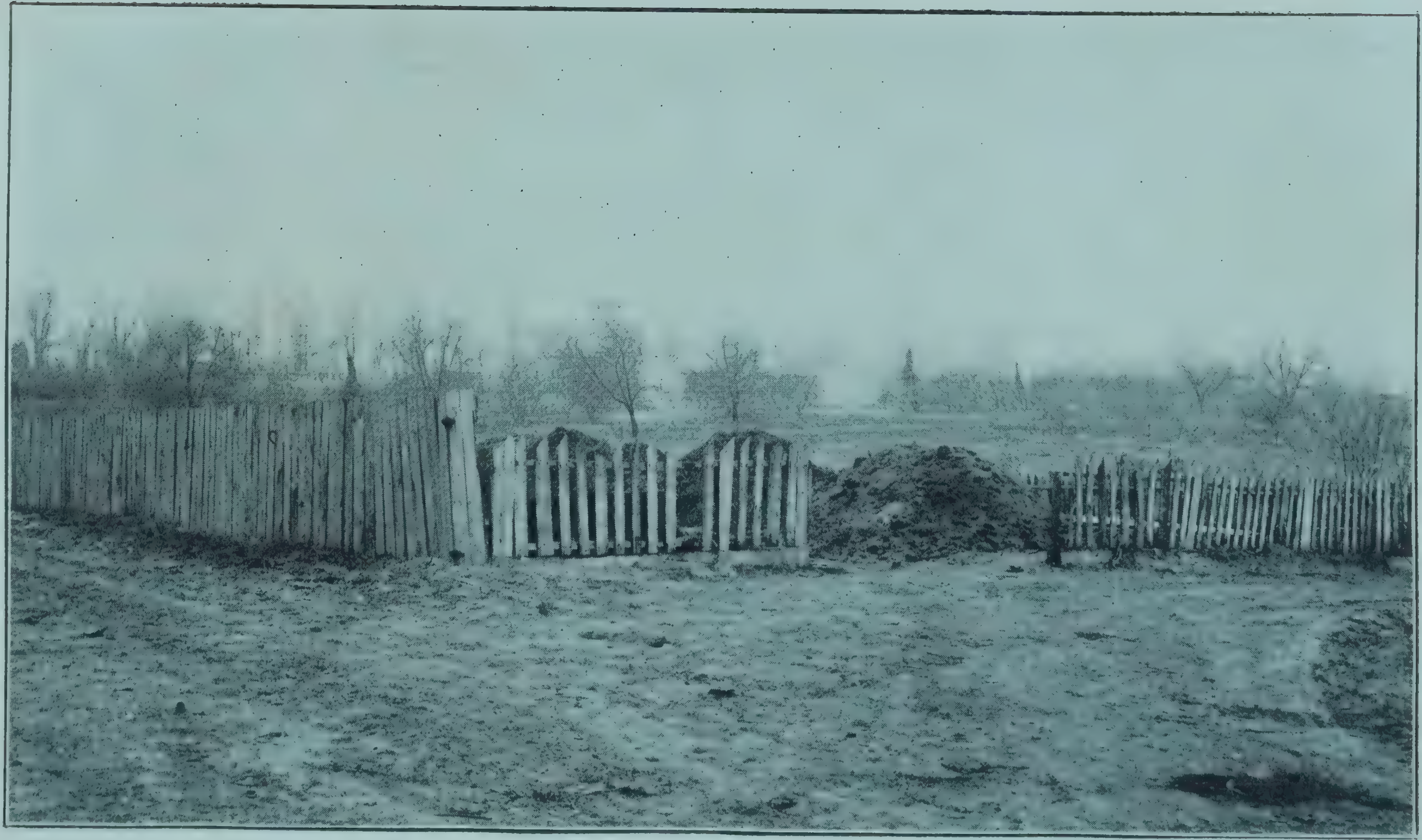


Figure 2. An unsightly fence and compost yard which very badly need screening off.

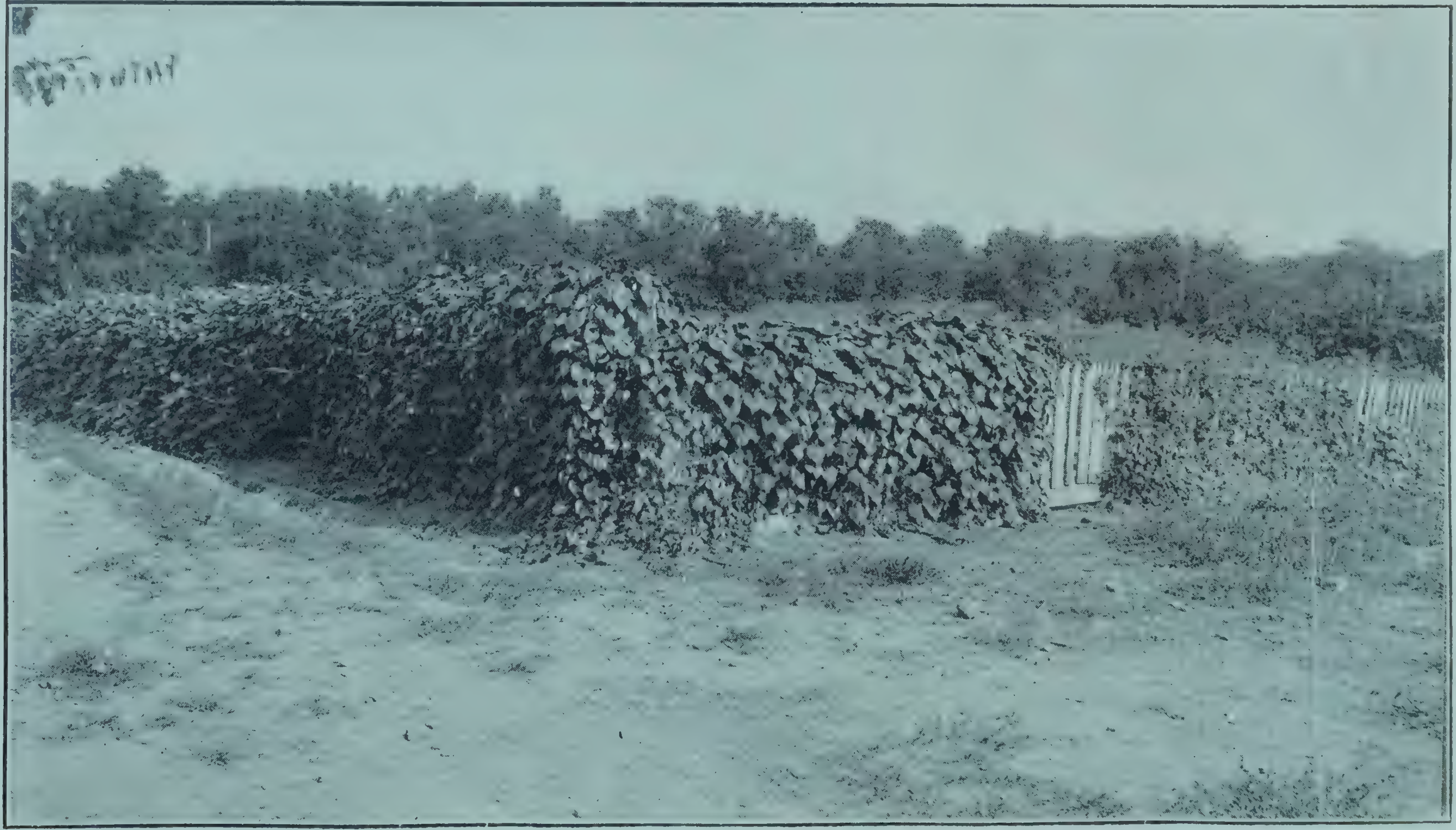


Figure 3. Same as Fig. 2, effectually screened by using the common morning glory and Hyacinth Bean (*Dolichos Lablab*).

the work realize the vast amount of labor and knowledge necessary to raise apples profitably, successfully. When I say knowledge, I mean not only the knowledge gained from reading and observation, but that most valuable knowledge gained from experience; you may call it all theory and practice.

There can be no set rules for cultivating, pruning, etc. We have general rules, and the grower must be ready to discriminate and seize upon and use that which is particularly adapted to his own particular soil, climate, variety, etc.

Mr. A may do so and so; his neighbor, Mr. B, possibly can do the same thing with like results, but probably not. It is just like raising children; parents must have an end in view, but to attain this end, and get the best out of each child, the parents must recognize and respect the individuality of each child. Many a child has had its disposition ruined by too much whipping—while a more careful study of the child, and taking the child for the beginning point and finding some other form of punishment, the end in view could have been accomplished without the child's disposition having been hurt. Now, don't think I eliminate whipping from the child's education; but there is a right and a wrong time for it. The phase of taking the child or the tree for the beginning point cannot be emphasized too much.

Now, then, if apple growing is a story of ten chapters, each chapter more or less intricate, and each tree, like each child, possessing its own individuality, how can we hope to make a success of 160 to 1,000 acres of orchard.

As children are the gift of God, given the mother to study and brood over, likewise are the trees given us for our careful consideration. The ideal mother is she who is the center of the home; so must the fruit grower (if he expects to be successful) be the center of his orchard. By that I mean be with and among his trees constantly, ready to detect the first symptoms of disease, and, finding the cause, get right to work to find a remedy and apply it.

To raise children is the work of a lifetime; to raise apples is a work of a lifetime. The mother's work is a work of love; the fruit grower's ought to be. Yet the mother has her disappointments, heartaches and perplexing problems, in which she needs the advice and help of others. The apple grower has all these, and let us hope that our grand old State will always have a society which has each individual grower's interest and progress at heart, and to which we can go and meet and receive the help and encouragement we all need. Do not let trouble and worry get the upper hand; it is energy wasted. Rather take as a motto: "Let's not talk about how hard the game is, but rather bend our energies to devising means toward overcoming the difficulties in our path."

I am decidedly in favor of small acreage, well and intelligently cared for, and more than one kind of crop to depend upon. If we do not like Mr. Erb's combination of apples and onions, try apples, strawberries, blackberries, or whatever else our soil will grow and *grow well.* Each grower ought to have for his own good, and the good of his own locality, an acre for experimental work.

The man or woman contemplating setting out an orchard ought to possess an extra well developed bump of discrimination, courage and perseverance. Give perseverance the colored man's definition: "Perseverance—firstly, to take hold; secondly, to hold on; thirdly, to nebber let go."

DISCUSSION.

Mrs. Moore—What is a model size orchard?

Mrs. Hodge—That depends a great deal on the grower himself. Eighty acres, I found, was too much trouble and took too much work to keep it up. Forty acres, I found, was enough for me, and I think will be for the average fruit grower, and will also be enough for others to take care of and make of it a profitable business. I would like to ask Mr. Dunlap, how much does he spray with one sprayer.

Mr. Dunlap—This depends on the season, but with one power sprayer from forty to eighty acres would not be enough. I should say 160 acres.

Mrs. Hodge—Certainly, one sprayer could do this amount of work, but how am I to know that I am getting my work done?

Mr. Dunlap—I usually find work enough on 160 to 200 acres to keep one man busy the year around. We usually work the 1,600 to 2,000 acres that we have in orchards in blocks of 160 to 200 acres. We had a tract of 80 acres and another of 160, and the man's work on the eighty was not so profitable as that man's work on the 160 acres.

Mrs. Hodge—Of course, the amount of work that you do may be extra large. I consider myself lucky if I take care of my forty acres right. Don't you find that the amount also varies with the age of the orchard?

Mr. Dunlap—Yes, to a great extent. If the tree is very large and high, and the man must shoot the spray up fifteen or twenty feet, the amount he can take care of is materially decreased. Then

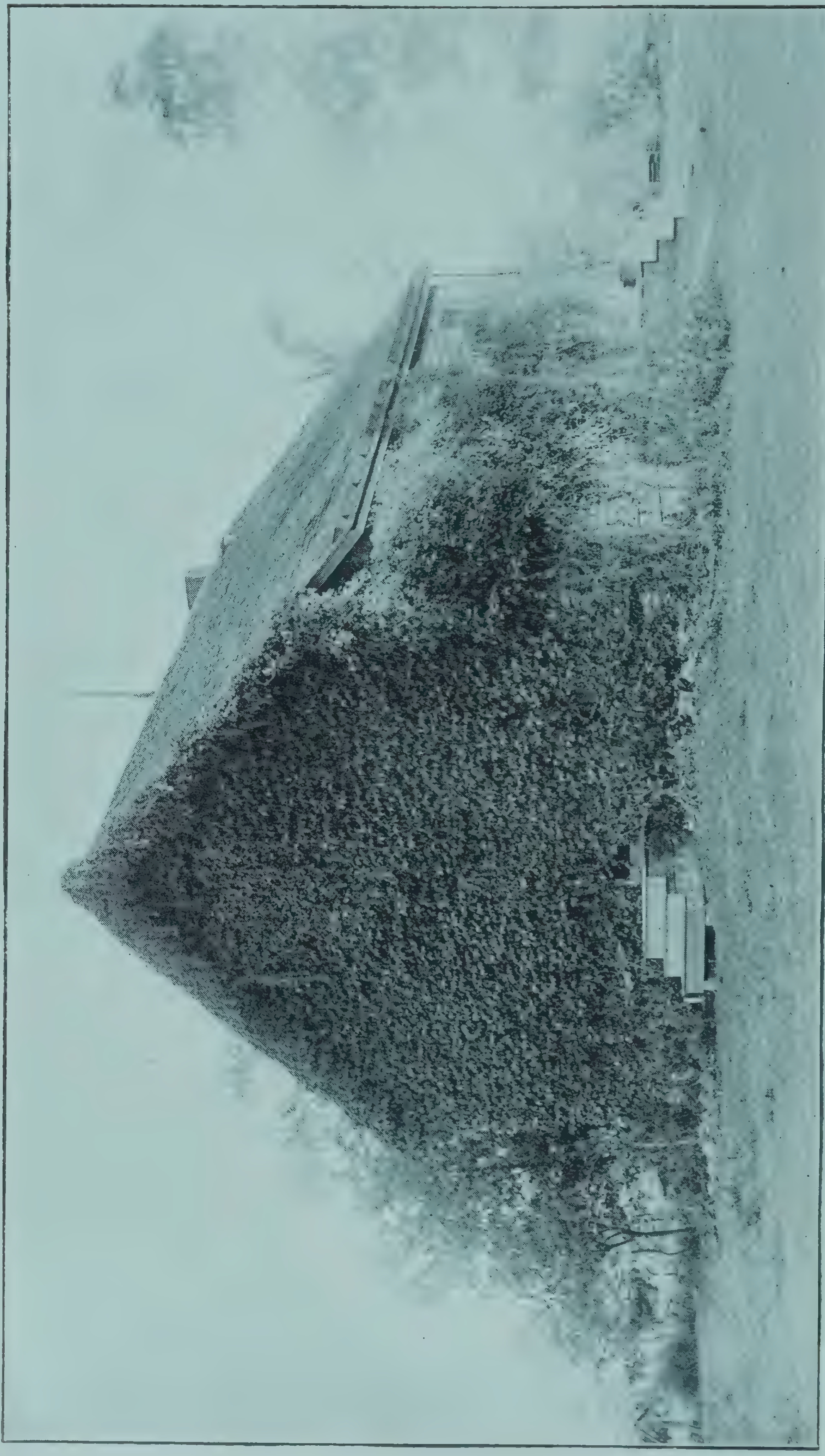


Figure 1. Native American Ivy, or Virginia Creeper (*Ampelopsis quinquefolia*), on a Southwest Missouri farm house.

again, the time of the season makes a great deal of difference, as much as the size and form of the tree. The foreman takes care during the spraying season to see that the work is done thoroughly.

SOME OF THE MOST DESIRABLE SHRUBS, CLIMBERS, AND PLANTS FOR DECORATING THE HOME GROUNDS.

(By Dr. J. C. Whitten.)

For my part, I desire for the decoration of home grounds, almost to the exclusion of the foreign plants and shrubs, our own native shrubs, which become, when cultivated and treated as we would treat a foreign plant, things of beauty, admired by all. So, in speaking of the decorations of home grounds, I shall, for the most part, deal almost exclusively with our own native shrubs, which may be secured by the farmer at the expense of a little labor and care.

One of the most decorative of our native climbers is the five-leaf ivy, or Virginia creeper, which is found growing wild. This plant does especially well on brick or stone walls. A stone fence may be made very beautiful by allowing this vine to run over it. Some people use trellis work and wire forms, but usually the best way is to allow it to run its course over the brick or stone buildings. It does not injure the building, but adds materially to its looks. Wooden frames may be used to advantage for the honeysuckle, the Japanese and coral creeper. They have a tendency to cause the wood of frame houses to rot, so that it is a good idea to keep them on wire trellises of some sort. A vine that will repay you for all the work put upon it is the trumpet creeper. It is one of the finest of the creepers and a plant that will go far toward covering up the barren spots on the surface of a large house.

Of the shrubs, I consider the native Missouri shrubs the most beautiful we can secure. The lowly, buckbush, when growing wild, is not a very nice looking plant, but when placed in the home grounds and given good cultivation and the plant allowed to grow without having to fight for existence, becomes a thing of beauty with its dark green foliage, and grows to a good size. The red berries in the fall and winter add a touch of color to that portion of the grounds in which they are planted. The sumach is another native shrub which responds favorably to cultivation and grows wherever planted, and is a thing of beauty the whole year long. The shrub is especially good for large tracts for the distant corner. These native shrubs do not attract us in nature, because they are, for the most part, not very beautiful. But when given the care and help we give other plants, they respond wonderfully, and people often ask where they may obtain them, not recognizing in these attractive forms the small, lowly plants they had known in their wild state. It is hard to get people to realize what the possibilities are with these plants until the demonstration is actually made for them, or they make it themselves. The elder is a good plant when not placed too close to the house and open windows. It is especially good for the back grounds, with its masses of fragrant blossoms and red berries which follow.

Some of the other native shrubs which may be mentioned as those deserving prominence in the selection are leatherwood, toothache berry and the haw. The latter grows to good size in the cultivated state.

For the trees of the home, I would follow out the same plan of selecting native trees for the grounds. Of course, different people have different tastes, but I prefer the Missouri native woods always. For a thin shade and a beautiful tree, the sugar, or hard maple, is one of the best. However, it is a slow grower, and one may substitute for it the soft maple, or start both kinds with the soft maple in a spot, that it may be cut out when the sugar maple gets to be of a good size. Other rapid growers are the sycamores, Carolina poplars and box elders. The poplars do well for a long, formal avenue. One of the most beautiful shade trees—a slow grower—is the native oak. This tree always grows to a good size and is of a fine shape, and the life is very, very long. For an avenue of trees, nothing can be nicer than our native elms. These grow at a moderate rate, and always have a symmetrical shape.

The wild grape is a very ornamental plant, with its dark green surface of leaves, and grows luxuriantly when cultivated. It makes almost as good a training vine as wisteria or trumpet creeper. People, as a rule, do not appreciate the possibilities of training vines over rough and ill-looking places. The house of the poorest construction, of the roughest boards, without any paint, is given an air of rest and quiet when vines are used to good advantage.

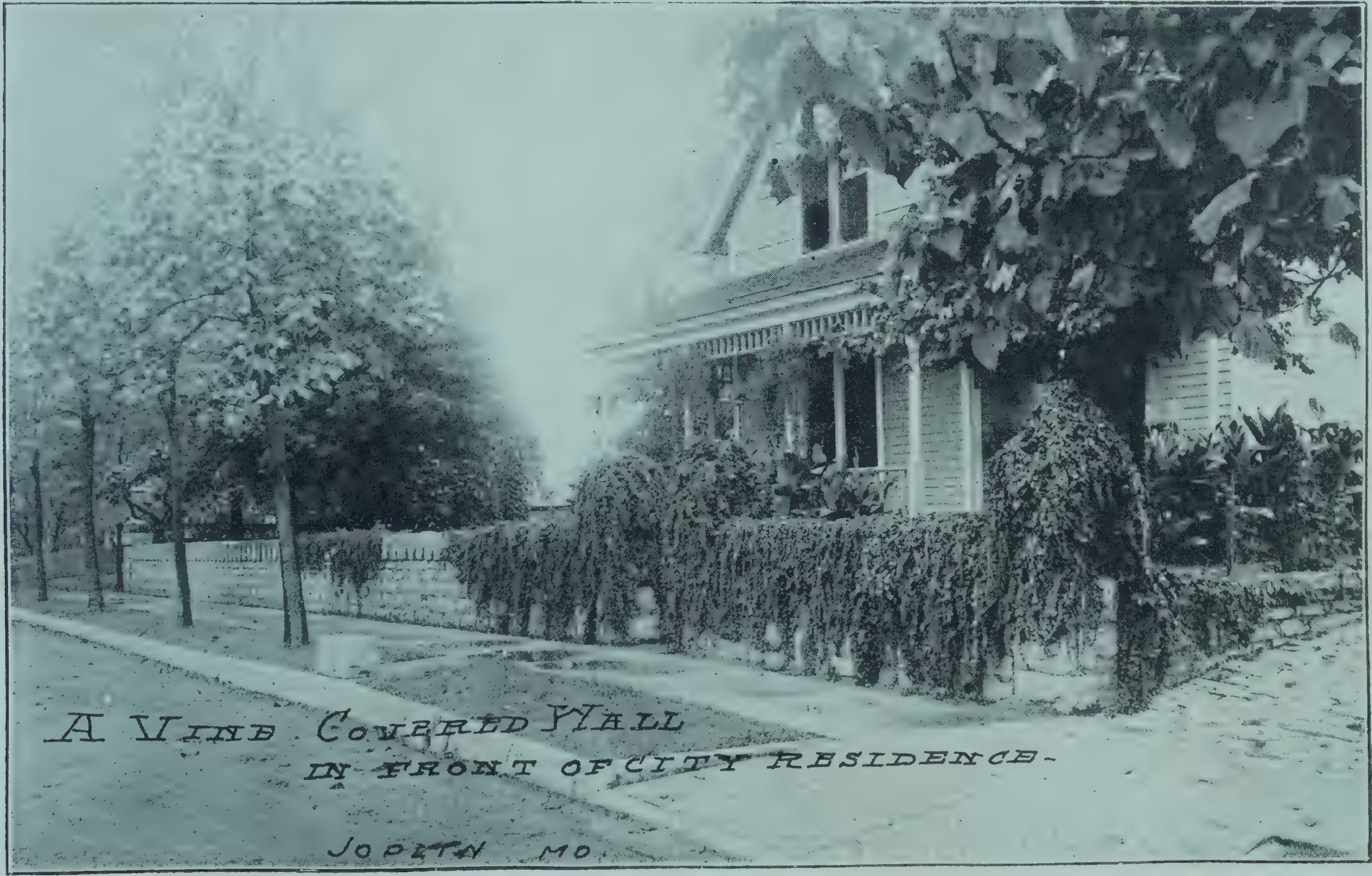

A VINE COVERED WALL
IN FRONT OF CITY RESIDENCE-
JOPLIN MO.

Figure 2. A vine-covered wall in Joplin, Mo. The vine is Virginia Creeper.

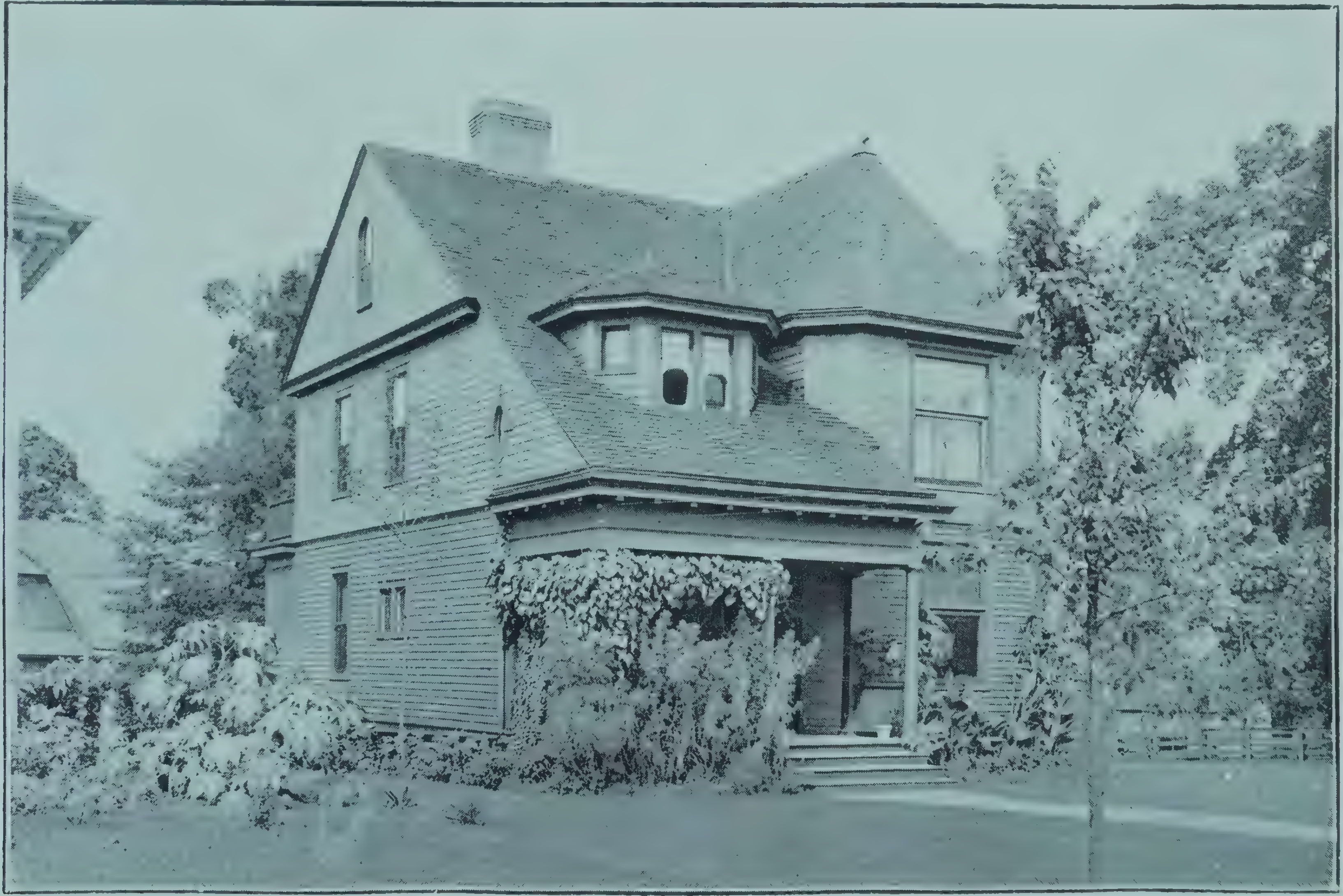


Figure 3. A home and front yard made beautiful by using annual vines for twining over the porch, and annual and other plants, like castor bean, canna, goldenrod, etc.

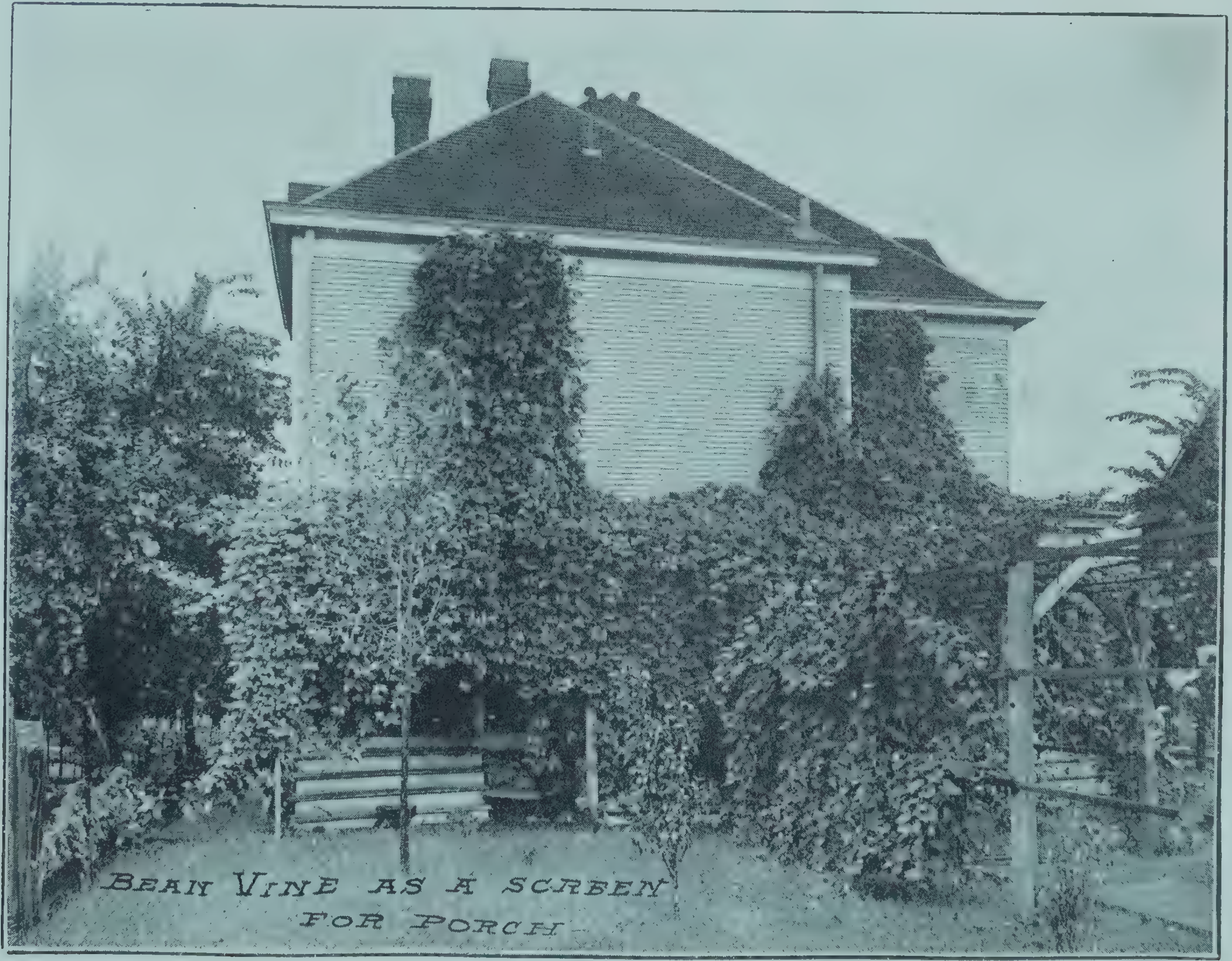

BEAN VINE AS A SCREEN
FOR PORCH

Figure 4. A house and arbor, covered by a single vine, which is the most wonderful grower of them all—the Kudzu Vine (*Pueraria Thunbergiana*).

REPORT OF COMMITTEE ON AWARDS, COL. J. C. EVANS, CHAIRMAN.

The following premiums were awarded and paid:

Mrs. Dego, cut flowers and plants	$5.00
Mrs. Musick, 2 splendid Boston ferns	2.00
Mrs. Brooker, cut flowers	1.00
Tippin & Fuerst, cut flowers	.50
W. C. Paynter, Koshkonong, display green peaches and raspberries	1.00
Mrs. Henry, cut flowers	.50

OBITUARY REPORT.

Nicholas F. Murray, Vice-President of the Missouri State Board of Horticulture, died at Kansas City, Missouri, May twenty-sixth, nineteen hundred and eight. In memory of our deceased brother, be it

Resolved, by the Missouri State Board of Horticulture, That, in the death of Brother Murray, our Board has lost a most useful member and the State of Missouri a valued citizen. Coming to Missouri at an early day, Brother Murray has taken an active part in the horticultural development of the west, and has always been a leader in every good work.

Resolved, That the sympathy of this Board and of the horticulturists of the State be extended to the bereaved family, and that a copy of these resolutions be transmitted to them.

We commend the bereaved ones to the love and care of Him, whom our brother has served so faithfully through the years, and who doeth all things.

Resolved, further, That space be set apart in the next annual report of this Board for a suitable memorial in honor of Brother Murray, and that this be submitted at the next annual meeting of this Board.

L. C. WILSON,
J. C. EVANS,
JAS. M. IRVINE,
Committee.

REPORT OF COMMITTEE ON FINAL RESOLUTIONS.

To the Honorable State Board of Horticulture:

Gentlemen—Your Committee on Final Resolutions begs leave to report as follows:

Resolved, That while the elements have not favored our meeting with such weather conditions as are usual at this time of the year, and while this interfered to a certain extent with the carrying out of the excellent program which was arranged for our entertainment, we nevertheless rejoice in expressing our gratification with the arrangements that have been made and the successful manner in which these arrangements have been carried out under the circumstances.

We desire to express to the citizens of Mountain Grove and to the Wright County Horticultural Society our thanks for the hospitality which has been extended to us. And we are especially thankful to the committee of ladies for the beautiful decorations of this hall.

It is quite unnecessary to say that we highly appreciate and are very grateful for the musical program which was arranged and so successfully carried out for our entertainment.

The thanks of the Board are due and herewith expressed to Mayor Candler for the use of this beautiful opera house, which so well served our purpose and made us all feel that we were properly appreciated.

The arrangements made by the officials of the Fruit Experiment Station for our entertainment, and the opportunity afforded us to become better acquainted with the work in behalf of Horticulture, which is so ably being conducted by them, was a delightful feature of our meeting, and our sincere thanks are due to Director Evans and his able assistants for same. We didn't mind the downpour of rain, because we knew it wouldn't hurt our fruit crops.

For these and all other blessings we are not only grateful, but sincerely hope that Providence will give Wright county a bumper fruit crop next year, and that the elements, if bound to do mischief, will keep busy in "Arkansaw."

LOUIS ERB,
J. C. WHITTEN,
R. M. HITT,
Committee.

WINTER INSTITUTE.

Held at Columbia, Boone County, Jan. 5, 6, 7, 8, 1909.

WINTER INSTITUTE.

Held at Columbia, Jan. 5, 6, 7, 8, 1909, in connection with all of the other State Farm Organizations of Missouri (The Corn Growers, Live Stock Breeders, Sheep Breeders, Swine Breeders, Dairymen, Bee Keepers, Housekeepers' Conference, Highway Engineers, etc.) which combine together during "Farmers' Week." Twelve hundred farmers were in attendance during the four days.

PROGRAM.

OPENING SESSION—TUESDAY EVENING, JAN. 5, 7:30 O'CLOCK.

Room 8, Horticultural Building.

"Western Pruning," illustrated, by J. M. Irvine, Editor of the Fruit Grower, St. Joseph, Mo.

Discussion led by Dr. J. C. Whitten.

"What is Horticulture," by Prof. J. C. Blair, Chief of Department of Horticulture, University of Illinois, Urbana, Ill.

"A Visit to the Georgia Peach Districts," by R. M. Hitt, Peach Grower and Member of State Board of Horticulture, Koshkonong, Missouri.

SECOND SESSION—TUESDAY AFTERNOON, JANUARY 5, AT 1:30.

Spraying Demonstration: Mixing and applying fungicides and insecticides, and handling of spraying machinery.

THIRD SESSION—WEDNESDAY MORNING, JAN. 6, AT 8 O'CLOCK.

Room 8, Horticultural Building.

"The Relation of Maturity to Hardiness in Trees," by Prof. R. A. Emerson, Head of Department of Horticulture, University of Nebraska, Lincoln.

"Hardiness of Peach Buds, Blossoms and Young Fruit, as Influenced by the Care of the Orchard," by Prof. W. H. Chandler, Assistant Horticulturist, Missouri Agricultural Experiment Station, Columbia, Mo.

"New versus Old Methods of Packing and Marketing Apples," by C. W. Wilmeroth, Treasurer of the Woods Commission Company of Chicago and a large and successful handler of fruits of many years' experience.

Adjournment to inspect the Fruit Exhibit, Corn Show or other objects of interest about the University. Those desiring to do so may spend this extra hour visiting the Open Session of the Swine Breeders' Association at the Auditorium in the main building of the University.

FOURTH SESSION—WEDNESDAY AFTERNOON, JAN. 6, AT 1:30 O'CLOCK.

Special Open Meeting in the University Auditorium.

Music by the Students' Cadet Band.

"Some Lines of Horticultural Development for Missouri," by Prof. J. C. Blair, Chief of Department of Horticulture, University of Illinois, Urbana, Ill.

"Arbor Day—Its Significance and Observance," by Mrs. J. E. MacKesson, Chairman Forestry Committee, Missouri Federation of Women's Clubs, Lebanon, Missouri.

"Missouri's Opportunities in Forestry," by Samuel J. Record, Forest Supervisor, Forest Service, United States Department of Agriculture, Washington, D. C.

Music by the University Band.

There will be no regular session in the evening for Horticulture alone, this date being devoted to the entertainment and instruction of all the visitors by prominent speakers representing various interests. This evening meeting will be held in the Auditorium, beginning at 7:30.

FIFTH SESSION—THURSDAY MORNING, JAN. 7, AT 8 O'CLOCK.

Room 8, Horticultural Building.

"Methods, Conditions and Future Prospects of the Fruit Districts of the West Compared with Missouri and Sister States," by T. H. Todd, apple grower and Treasurer of the Missouri State Board of Horticulture, New Franklin, Mo.

"How to Grow and Care for Grapes," by E. A. Riehl, Alton, Ill., well-known writer and horticulturist.

"Why We Prune," by Dr. J. C. Whitten, Head of the Department of Horticulture, University of Missouri.

SIXTH SESSION—THURSDAY AFTERNOON, JANUARY 7, AT 1:30.

Pruning Demonstration: Practical exercise in pruning grapes, apples, peaches, etc., together with a study of the location of fruit buds and wood buds in their relation to pruning.

THURSDAY AFTERNOON, 3 O'CLOCK.

Room 8, Horticultural Building.

"How Horticultural Crops are Saved from Insects in Colorado," by Prof. E. P. Taylor, formerly of Colorado, but now Entomologist of the Missouri Fruit Experiment Station, Mountain Grove, Mo.

"How the Insect Situation Has Been Handled in Illinois with Special Reference to Horticulture," by Prof. J. A. West, Assistant State Entomologist, Urbana, Ill.

"The Leading Insect Problems of the Year," by Prof. J. M. Stedman, Head of the Department of Entomology, University of Missouri.

Thursday evening at 7:30 o'clock all of the visitors will meet in the Auditorium for a general session, at which prominent speakers of national reputation will speak on subjects of live interest to farmers and fruit growers.

SEVENTH SESSION—FRIDAY MORNING, JAN. 8, AT 8 O'CLOCK.

Room 8, Horticultural Building.

"How to Can Fruits and Vegetables on the Farm," by Mrs. Mabel E. Moore, a successful home canner of all kinds of fruits for home use and local markets, Cabool, Mo.

"Orchard Cover Crops," by W. P. Stark, nurseryman and fruit grower, and President of the Missouri State Board of Horticulture.

Early adjournment to visit Open Session of The Missouri Corn Growers' Association at the Auditorium, where the general subject under discussion will be "Corn Improvement."

EIGHTH SESSION—FRIDAY AFTERNOON, JANUARY 8, AT 1:30.

Propagation exercise by students of the Agricultural College.

FRIDAY AFTERNOON, 3:00 O'CLOCK.

Room 8, Horticultural Building.

"The Strawberry as Grown Commercially in the West," by J. H. Christian, Neosho, Mo., a successful strawberry grower and member of the Missouri State Board of Horticulture.

"A disease of neglected Peach Trees," by Prof. F. M. Rolfs, Pathologist, Fruit Experiment Station, Mountain Grove, Mo.

"Growing Cantaloupes in Colorado as Seen by a Missourian," by L. C. Wilson, South St. Joseph, Mo., fruit grower and Member of Missouri State Board of Horticulture.

"Impressions of the Orchards and Orchard Districts of the West," by W. L. Howard, Secretary Missouri State Board of Horticulture, Columbia, Mo.

FRIDAY EVENING, 7:30 O'CLOCK.

Dining Room of Lathrop Hall.

Grand Banquet tendered by the Agricultural College to all visitors.

PREMIUM LIST.

N. B.—A plate of apples, pears or quinces shall consist of five specimens. All fruit exhibited for prizes must be on the tables by Wednesday noon of January 6th.

CLASS I.—APPLES.

1. Best Collection of Apples of not less than six nor more than fifteen varieties:

First Prize	$20.00
Second Prize	10.00
Third Prize	5.00

		1st.	2nd.
2.	Best Collection of not more than five New Varieties of Apples	$3.00	$2.00
3.	Best Single Plate of a New Variety of Apple, good enough to be recommended	3.00	2.00
4.	Best Plate of Seedling Apples, good enough to be recommended	3.00	2.00
5.	Best Four Varieties Winter Apples for Market.	3.00	2.00
6.	Best Four Varieties Winter Apples for Family Use.	3.00	2.00
7.	Best Three Varieties Fall Apples for Market.	3.00	2.00
8.	Best Single Variety Winter Apples for Market.	2.00	1.00
9.	Best Single Variety Winter Apples for Family Use	2.00	1.00
10.	Best Single Variety Fall Apples for Market.	2.00	1.00

11.	Best Single Variety Fall Apples for Family Use	2.00	1.00
12.	Best Plate of Ben Davis	2.00	1.00
13.	Best Plate of Gano	2.00	1.00
14.	Best Plate of Jonathan	2.00	1.00
15.	Best Plate of York	2.00	1.00
16.	Best Plate of Grimes	2.00	1.00
17.	Best Plate of Ingram	2.00	1.00
18.	Best Plate of Winesap	2.00	1.00
19.	Best Plate of Missouri Pippin	2.00	1.00
20.	Best Plate of Wealthy	2.00	1.00
21.	Best Plate of Maiden Blush	2.00	1.00
22.	Best Plate of Huntsman	2.00	1.00
23.	Best Plate of Rome Beauty	2.00	1.00
24.	Best Plate of Payne's Keeper	2.00	1.00
25.	Best Plate of Benoni	2.00	1.00

CLASS II.—PEARS.

26.	Best Collection of Pears of not less than six nor more than fifteen varieties:		
	First Prize	$10.00	
	Second Prize	5.00	
	Third Prize	3.00	
27.	Best Collection of not more than five New Varieties of Pears	3.00	2.00
28.	Best Single Plate of a new variety of pear, good enough to be recommended	.200	1.00
29.	Best Plate of Seedling Pear, good enough to be recommended	1.50	.75
30.	Best Plate Keiffer	1.50	.75
31.	Best Plate of Garber	1.50	.75
32.	Best Plate of Duchess	1.50	.75
33.	Best Plate of Anjou	1.50	.75
34.	Best Plate of Seckel	1.50	.75
35.	Best Plate of Lincoln	1.50	.75
36.	Best Plate of Krull	1.50	.75

CLASS III.—GRAPES.

37.	Best Collection of not less than six nor more than fifteen varieties:	
	First prize	$10.00
	Second Prize	5.00
	Third Prize	3.00

38.	Best Collection of not more than six new varieties of Grapes	2.00	1.00
39.	Best Single Plate of new variety of Grape, good enough to be recommended	1.50	.75
40.	Best Plate of Seedling Grape, good enough to be recommended	1.50	.75
41.	Best Plate of Concord	1.50	.75
42.	Best Plate of Worden	1.50	.75
43.	Best Plate of Moore's Early	1.50	.75
44.	Best Plate of Diamond	1.50	.75
45.	Best Plate of Niagara	1.50	.75
46.	Best Plate of Wyoming (Red)	1.50	.75
47.	Best Plate of Woodruff Red	1.50	.75
48.	Best Plate of Norton	1.50	.75
49.	Best Plate of Cynthiana	1.50	.75
50.	Best Plate of Uhland	1.50	.75
51.	Best Plate of Missouri Riesling	1.50	.75
52.	Best Plate of Catawba	1.50	.75

CLASS IV.—QUINCES.

53.	Best Collection of three varieties of Quinces	$5.00	$2.50
54.	Best Plate of Missouri Mammoth	1.50	.75
55.	Best Plate of Orange	1.50	.75

CLASS V.—SPECIAL.

56. Any horticultural product not included in the above may be eligible for special premiums in this class, if deemed worthy by the judges, although not more than $25.00 in prizes shall be awarded under this class.

STYLES OF PRUNING PRACTICED IN THE NORTHWEST.

(Abstract of illustrated talk made by James M. Irvine, Editor of the Fruit-Grower, St. Joseph Mo., before the annual meeting of the Missouri State Board of Horticulture.)

In discussing this subject, I desire to disclaim any intention of recommending to our fruit-growers that they follow any of the styles of pruning which will be shown on the screen. I simply want to show them the pictures, and give the arguments in favor of and against the different plans, as they were explained to me while in the fruit districts of the Northwest during the past summer.

From the time we started to visit orchards on the western slope of the Rocky Mountains, in Colorado, until the last orchard had been visited, we were impressed with the fact that the western fruit-grower practices more heroic pruning than his competitor in the states east of the Rocky Mountains.

In most of the sections visited, the planters prefer one-year apple trees; many growers will not have two-year trees as a gift, for they say they want to shape their trees according to their own fancy, and this can be done better with one-year trees than with those which have grown in the nursery for two years, and which have been shaped, to some extent, by the nurseryman.

In planting one-year trees they are cut back to a stub, just as we cut back our peach trees. The young trees are cultivated thoroughly to induce a vigorous growth, and the first season the work of training and shaping the trees is well under way. In Colorado, most of the growers prefer to train their apple trees to vase shaped, with open center. To do this, it is necessary that the scaffold limbs, which are to form the main truss of the tree, be started just right. Some growers want three of these scaffold limbs, more of them prefer four, and still others will leave five or more. The ideal tree of this type will be where these scaffold limbs come out from the main trunk at intervals, and where none is opposite another. In this way bad forks will be avoided, which have a tendency to split apart when the limbs are supporting a heavy load of fruit.

I will show some pictures of trees in the orchard of Dr. A. E. Miller, Austin, Colo., which will illustrate this vase style of pruning. Dr. Miller has trees headed high and others headed low in this orchard, and one can readily see how much better are the low-headed trees. All of the scaffold limbs are upright in their nature, so that they might well come out from the trunk, at the surface of the ground, and still they would carry their load of fruit high enough to keep it off the ground.

With this style of tree, the grower seeks to keep the center open, to admit sunlight and air, and no limbs are allowed to grow toward the center. Fruit spurs will come out all along the limbs, and as the head of the tree is open, all this fruit is well colored and every apple can also be reached when the trees are sprayed.

This vase style of tree is the one which is preferred in most parts of the Northwest, perhaps, but various plans of handling the tree after the shape has been fixed are practiced. For instance, the Colorado growers believe in cutting back the new growth, just as we do peach trees, to keep the bearing wood near the main scaffold limbs, and to keep the tree lower, so that the fruit can be more easily sprayed, and picked with less labor. The Colorado Experiment Station has been perhaps the most enthusiastic institution in recommending this style. Some growers have objected to this method, claiming that when the scaffold limbs are loaded with fruit they will split apart. It is claimed by the station authorities, however, that if the limbs are properly shortened in, the weight of fruit will be nearer the center of the tree, and nothing of this kind will happen.

I might mention in passing, that where bad forks occur it is a comparatively easy matter to make one limb brace the other. One way to do this is to allow a small branch to grow toward the center, putting out from one limb, and on the scaffold limb, on the opposite side of the tree, allow another branch to put out in this same way. When these small branches meet, wrap them about each other, and they will eventually grow together, making a living brace.

Another plan, and perhaps a more practicable one, is to insert on the inside surface of one scaffold limb a small screw-eye, and another on the inside of the limb on the opposite side of the tree. Attach a wire to each of these screw-eyes, and when all the scaffold limbs are so equipped, attach the loose ends of the wires to an ordinary iron ring in the center of the tree. This plan makes every limb brace every other limb on the tree; the tree can be swayed by the wind, and all the limbs will move together. And yet one limb cannot break away from the others because of its load of fruit. This is the plan practiced by Mr. A. I. Mason of Hood River, Oregon.

Another plan, but one which is not so satisfactory as Mr. Mason's plan, is to insert the screw-eyes as recommended above, and then run a wire from one across to the opposite limb. This plan allows one limb to brace one other—but unless they are directly opposite the results will not be satisfactory.

To go back to the style of pruning practiced in Colorado: by continually cutting back the new growth, making the cut where a side branch comes out, the branches naturally take on a very crooked growth; they are not symmetrical, but they bear enormous quantities of fruit. Apples are found all along the limbs, instead of at the ends of the branches only, as is true where the center of the tree is filled with the brush, which prevents sunlight from entering.

Going on through the Northwest, it was found that many growers followed this general plan. Some preferred to maintain the central leader, carefully cutting out some of the center of the tree each year; but most growers prefer the open center, no central leader, but the scaffold limbs providing the main framework of the tree.

Of course the style of pruning varied with the different varieties of trees. Spitzenberg limbs are long and willowy, and must be carefully handled to produce an ideal tree. Jonathan limbs insist on growing in a spreading fashion, and if one wants the scaffold limbs to be upright they must be trained in this way.

In parts of the Williamette Valley, in Oregon, we found that some of the old orchards had been left unpruned for many years, and then heroic cutting-back was practiced. In some cases limbs three inches in diameter were cut back, and this severe pruning was admittedly not best for the tree—it would have been better by far to have done a little pruning every year, so that such severe pruning would not have been necessary.

At Wenatchee, Wash., in the orchard of Mr. T. W. Clark, every effort is being made to get the scaffold limbs where wanted. If the limbs are inclined to grow too upright, as may be true of Spitzenberg, stakes are driven into the ground, and the limbs are tied to them, until they become fixed in that position. If the limbs are inclined to grow too sprawling, they are drawn into a more upright position. When these scaffold limbs are once established, then all pruning will be such as will induce the formation of fruit spurs near the center of the tree, so that the tree can support an enormous weight.

In some sections we found that trees are inclined to make too much wood growth, just as they are in parts of Missouri. The Northwestern grower practices summer pruning to overcome this, and to induce the formation of fruit buds. July is a good time to do the work, and many growers are busy pruning their trees at that season.

At every place visited we asked the growers what they thought of their style of pruning for trees in the Middle West. Many of these Northwestern growers came from the Mississippi Valley, and we failed to find any of them who did not believe that our growers can practice much more severe pruning than we have thought possible. The objection is urged that our trees will sunscald if opened up in the center. The Western man says, in reply to this:

"Of course they will, if they are allowed to form a dense head, and it is then opened up, exposing the tender bark to the direct rays of the sun. But if the trees are kept with open heads from the time they are planted, there will be no trouble on this score. We have almost continual sunshine, and in summer the sun is very hot—and if our tree's will stand the exposure, why will not yours?"

These growers insist that if the head of the tree is open from the start, the bark will become used to the exposure. A man can work all day in the sunshine, and the skin on the back of his hand will not blister, for it is accustomed to the exposure. Let the man remove his shirt sleeve, however, and the uppert part of his arm will be blistered before night. Yet the skin is the same—the difference is in the previous treatment. Accordingly, where a tree is shaped with an open center at the time it is planted, it will not be more likely to sun-scald than another tree which has all the wood left in the center.

One other objection, it seems to me, which may be made against their style of pruning, if several limbs come out from the trunk of the tree directly opposite, is that the fork which is formed may be somewhat cup-shaped, and would hold water. Of course where no rain falls this is no objection, but it might prove so with us.

While I would not recommend this style of pruning for our growers, I confess I am unable to see why it is not suited to our conditions, with perhaps some modifications. Trees with an open center can be more easily sprayed, the trees can be made to produce maximum crops, and the fruit can be gatherd at less expense than under our plan of neglecting the trees altogether.

Everyone who visits these up-to-date orchards must come away with the conviction that our trees produce too much wood and not enough fruit. There is not the slightest doubt in my mind that our trees should be pruned more severely than we have heretofore thought advisable, and I am almost tempted to say I believe it is better to err on the side of pruning too much than not enough.

The Western growers are progressive. They produce large crops of fruit of good quality—and the wise growers of all the states east of the Rocky Mountains can well afford to study their methods and adopt such as seem to be adapted to our conditions.

I confess I don't know to what extent we can follow their style of pruning—but I am certainly convinced that our trees need more pruning than they have been receiving, and I would like to see one orchard grown according to the plan which is proving so successful in the Western states. It will be well worth trying, at any rate.

DISCUSSION.

Mr. Holsinger—I have made some radical changes in my attitude toward pruning in the last few years. I have pruned in the past, but will not prune in the future. I shall cultivate and not prune; leave more to the plow and not so much to the knife. I believe that we should shape a tree as it grows. Some may do this with pruning. Different conditions give different methods, but I prefer not to prune so much as I have in the past.

Mr. Riehl—We have had this open pruning, to a limited extent in Illinois, but the system generally followed is the "umbrella" shape with the outside limbs getting most of the sun and very little sun on the inside limbs. This may not do for peaches, but I believe that we should follow apple pruning in the same way as we have been doing. If you open your tree and allow the sun to come in at once with no small limbs on the small branches you will get sun scald.

Mr. Cupp—There are perhaps many here who do not believe in open pruning on account of sun scald. If you force the trees when they are small, to open up, you will not be troubled with sunscald.

A VISIT TO THE GEORGIA PEACH DISTRICT.

(By R. M. Hitt, Member of the State Board of Horticulture, Koshkonong, Mo.)

I am very glad to report that I saw nothing in Georgia that would lead one to believe that the Georgians could excel some sections of Missouri in peach growing. As a whole, the Georgia orchards are apparently better kept. It is also a fact that there are more peaches shipped from Georgia than from Missouri. On one day during my trip, there were 280 carloads shipped from the state; probably more than were shipped from Missouri during the entire season. But the peach districts in our State are undeveloped, and the industry, from a commercial standpoint, is practically in its infancy.

It was impossible for me to visit all of the large shipping points, and on acount of our own crop ripening about ten days earlier than usual, I was forced to shorten my trip, and pass by several points of interest to a peach grower.

In order to make my trip profitable, if possible, not only to myself, but to the fruit growers of the State, I endeavored to find out the most serious obstacles to peach growing for profit, and the best methods to overcome the same. This in some instances proved to be rather an arduous task. One of the first gentlemen I met told me that results this year had forced them to the following conclusion, with regard to the peach business, "That everything that was so, is not so, and everything that was not so, is so." He had never seen conditions so reversed as they were this past season.

Missourians generally have always expressed great fear and dread of the San Jose scale, and it is right that we should feel that way and continue to use every precaution to keep it from getting a strong, fast hold in the State. Since my trip to Georgia, where, as you probably know, the scale is in nearly every section, I have very much less fear of the scale. They fight it mostly with the lime-sulphur wash and manage to keep it under control. While driving along the road in the fruit valley district, with a gentleman who was better acquainted with conditions there than myself, he remarked that we could stop any place and approach the nearest tree and find scale, which proved to be a fact after several trials. Yet they had just harvested an immense crop from those same trees. Several growers told me they had sprayed, with good results, for the curculio, with arsenate of lead; but spraying peaches except for the scale does not seem to be generally followed.

I found no one who could tell me positively what to do for the brown rot, which in my opinion, is the most serious thing confronting the Ozark peach grower today. It seems to be the general opinion that the rot can be controlled somewhat, but not entirely, by setting the trees farther apart and keeping the centers well cut out, so as to have plenty of sunlight and air throughout the tree. They are damaged with this fungus disease in Georgia to just as great an extent as we are in Missouri. Some advanced the idea that where cowpeas were planted extensively they were largely responsible for the rot. The cowpeas, they claimed, caused too much wood and foliage growth. Personally this theory did not appeal to me. It is much easier to correct too much growth than not enough.

I found that potash was used quite extensively, and they told me you could tell the row where it had been applied by the color of the fruit. I was also told of a block of Carman with Elbertas on two sides. The condition of the soil, fertility, elevation, drainage, etc., were practically the same. Muriate of potash, 150 pounds to the acre was applied to the Carman and they were practically free from rot while the Elbertas on both sides of the Carman, without potash application, rotted badly. This observation was made in this instance where the potash had been applied to produce color, but we could not, of course, conclude that potash would prevent brown rot.

In only a few orchards did I notice any particular system of pruning followed. This I was told is due largely to the fact, especially in Southern districts, that they have to depend almost entirely upon negro labor for their field hands and it was next to impossible to train or teach them to follow a system or even exercise good judgment.

The best peaches I saw came from an orchard where the "tripod" system of pruning was followed as near as possible. This orchard had also been sprayed with arsenate of lead, and I saw the best color and as few imperfect peaches, worms, rot, etc., as in any district visited.

Generally speaking, the packing of the fruit is systematized better than in our State, which I attribute to the fact that they have been engaged in the business longer than ourselves. In nearly all of the larger orchards the peaches are graded and culled by hand before reaching the packer. In one orchard, the following system was used in picking and packing their fruit: The pickers and packers were all numbered and each one was supplied with tickets upon which were printed their respective numbers. Each picker placed in the bottom of each basket picked, a ticket; when the baskets were emptied by the graders at the shed, the tickets were there to show who had picked the fruit, and if not properly done it was an easy matter to correct the one at fault. The packers placed a ticket on each crate packed and these were collected by an inspector and he would likewise locate any one not doing his work properly. Each night the tickets were all collected and sorted, and the next morning, on a bulletin where all could see, was displayed the work every hand had done. An incentive to those who were slow and a quick means of finding out those who were worthless, was the result. In short, the work was systematized, as any well regulated business must be for success.

The marketing of the crop seemed to be handled much the same as it is in Missouri. There was not much organization. The large growers worked individually in most instances. Those with whom I had the opportunity of speaking along this line, did not seem to think favorably of co-operation to assist in the distribution of a large crop. On the day already mentioned, when 280 cars were shipped from the state, 121 of them went to New York City. I met growers who shipped their entire crop each year to New York City, regardless of the condition of that or any other market.

In conclusion, I would say to peach growers of Missouri, that we have sections in our State just as well adapted to the growing of peaches as any place I visited in Georgia. What we need most is up-to-date methods, first, in the care of our orchards, and second, in the packing of our fruit. The successful growers in Georgia are those who study and practice these points.

DISCUSSION.

Mr. Stark—Did you notice the picking of green peaches in Georgia?

Mr. Hitt—No, not on the orchards that were well superintended. They did not pick, anywhere, very many peaches that were green. That is one point of the business we can learn from Georgia growers. Some of the peaches were picked pretty ripe.

Mr. Wilson—Where can we have an improvement? In just what point do we fall below Georgia?

Mr. Hitt—We can have an improvement in several different lines. In marketing and packing, perhaps, more than anywhere else. They cool and grade the peaches before they reach the packers. In some places I have seen several different sized peaches in the same package. The packers are not so expert in Georgia as they are in Missouri. By a little co-operation we can far surpass Georgia in marketing. A peach crop, when it becomes ready to pick, must be picked and some one must be ready to consume it.

Mr. Howard—Have they tried placing the peaches in cold storage as they have done in the West?

Mr. Hitt—They were evidently storing some. One of my brothers was in New York City during our shipping season and he said that they were selling Georgia peaches from storage. I do not know how long they will keep.

Mr. Stark—To what extent are they now pre-cooling before shipment?

Mr. Hitt—I did not see any of it done and did not get in touch with any of the shippers doing it.

Mr. Todd—You said the scale was found on the trees after the crop had been picked. Was any found on the fruit before picking? Have they instructions to look after this fruit?

Mr. Hitt—It was on every tree we looked at. I saw scale on several peaches in packages. There is no inspection of the fruit. I asked one of the farmers about such infected fruit and he said that they said nothing about it.

Mr. Todd—The reason I asked about this matter, was to bring it before us and have the matter discussed. Captain Shawhan and I were together at Payette, Idaho, and were going around among the shipping sheds and I heard an argument between two gentlemen in one of the shipping sheds. One of the gentlemen was a shipper and the other was the fruit inspector. The inspector stated there was scale on the fruit. The shipper said there was not. The inspector said that the apples could not leave the shed. The shipper asked the inspector what he was to do with them. "I don't know," replied the inspector, "but you cannot ship them." This story shows you the laws and regulations that they have in some of the states. I learned in some cases that whole cars were not allowed to go on account of the presence of scab, scale and other diseases.

Mr. Royer—How often do we get a crop of fruit in the Koshkonong district as compared with Georgia?

Mr. Hitt—In Southern Georgia they get crops more often than we do. There they have had three successive crops. For the last three years we have had three crops though they have not all been large ones. We will compare favorably with Northern Georgia, but not favorably with Southern Georgia. Next year we will probably have a heavy crop from old orchards. There is a heavy crop of fruit buds on the old trees. Last year the fruit was almost entirely killed on the south slopes. This year conditions were reversed and the peaches were killed on the north slopes and our crop we saved was on the south slope. But peach growing is a long story.

Mr. Irvine—In my trip west, I examined a crude pre-cooling house at Wentachee, Washington. There we saw the shipping associations handling the cold storage proposition very well, indeed. The fruit is placed in the car and stands over night at a temperature of 30 degrees and shipped. But recently they have changed this somewhat. The fruit is now packed into the car and an exhaust fan is used to get rid of all the warm air and fruit gases before refrigeration begins. As the air is withdrawn from the car through the fan it returns by coming over the ice and the temperature is gradually lowered and at the same time all gases are withdrawn. This can be done in a comparatively short time and after the chilling has been thoroughly accomplished, the hose from the fan is withdrawn, and the fruit is ready for a long shipment. Thus the temperature of the car has been reduced and the gases have been eliminated, which usually takes two or three days to do under the old system. And, too, after it has been precooled, the shipment goes better than under the old system of refrigeration. This is because of the immediate removal of the warm air and gases.

In reference to the treatment in the West, of fruit affected with scale and other diseases, I think that the scale is seldom spread from fruit. But is is a yielding to the man who has the affected trees, and the scale will surely spread from these. If they should give up to the man with the diseased fruit, "what about the trees," they ask? It is simply an indirect method to make the man take care of the trees he has planted. But in the case of codling moth it is different. The insect was probably first disseminated in this section from a shipment of fruit. You can seldom find fruit affected with apple scab in that country.

HARDINESS OF PEACH BUDS, BLOSSOMS AND YOUNG FRUITS AS INFLUENCED BY THE CARE OF THE ORCHARD.

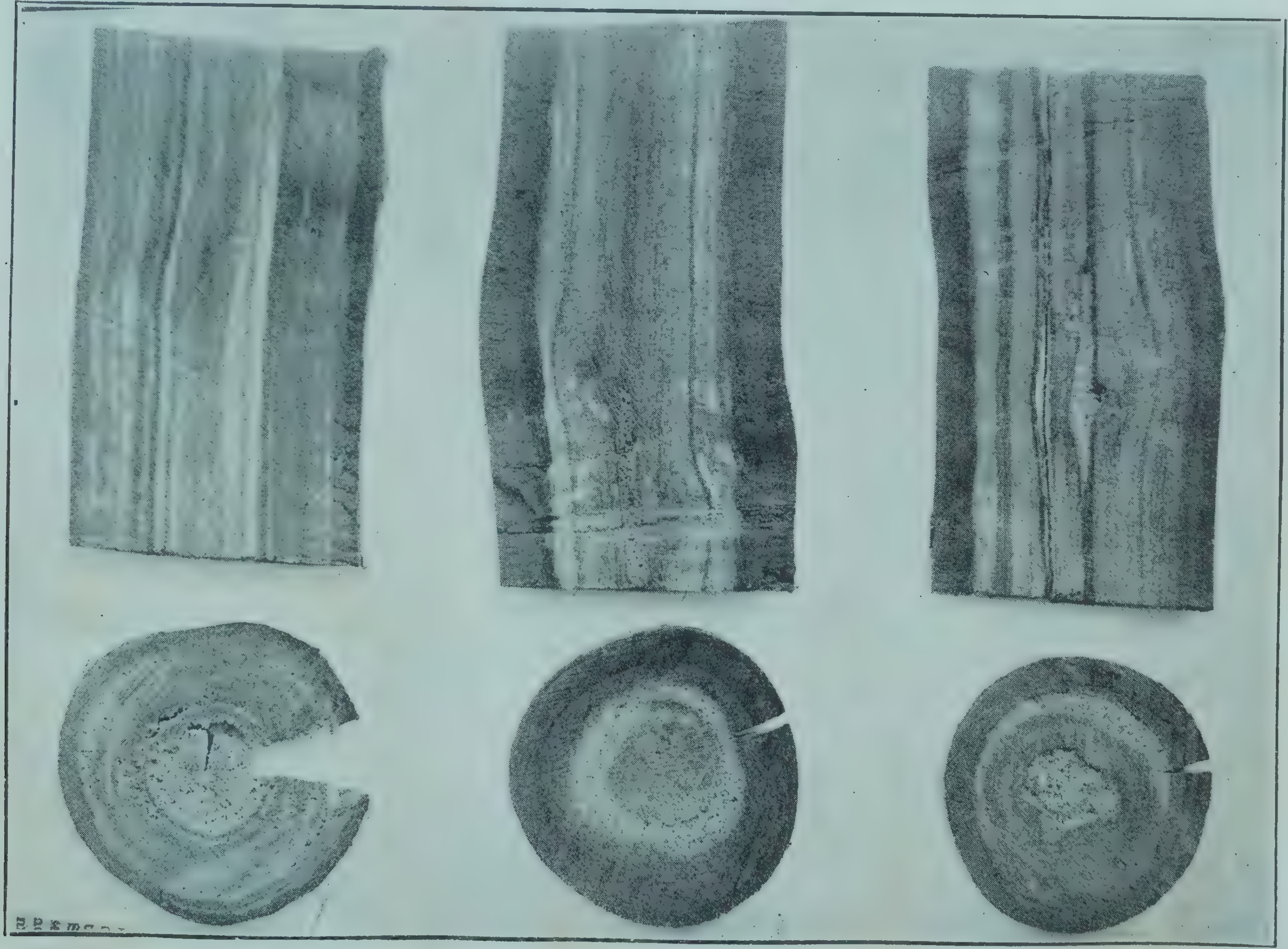
(W. H. Chandler, Asst. Horticulturist, Missouri Agricultural Experimental Station.)

In discussing this subject, the fact must not be lost sight of, that the most important factor influencing the probability of man's getting a peach crop, is elevation or good air drainage. I am sure that the experience of the Missouri peach growers, especially of those in South Missouri will bear me out in this statement. As compared with proper elevation the influences to be discussed in this paper are slight.

However, when it is considered that often only three to ten per cent of the buds set would be sufficient to produce a good crop of fruit, it will be seen that anything that influences the hardiness of buds only slightly may be of great practical importance. The buds were counted on a number of trees in the Missouri Experiment Station orchard in the fall of 1907, and on one tree, more than 22,000 buds were found, on another, more than 23,000, and on another, more than 33,000. One thousand fruits would not be a bad crop. Then too, since the peach crop on certain orchards of considerable size in this State was almost a failure while other orchards, apparently similarly located with reference to air drainage, bore a profitable crop, a discussion of the effects of the care of the orchard on hardiness, would not seem to be out of place at this time. In discussing loss of peach crops from cold we have to do with at least four phases that should be kept distinct. The peach crop may be killed by severe cold periods coming when there have been no warm days to start the buds, or by cold periods, often not so severe, coming after the warm days that have started the buds into slight growth. The crop may also be lost by frost injury at blooming time, or by frost injury after the peaches have reached a considerable size. It is plain that the condition of the trees that favor greatest hardiness may be different for each of these phases.

COLD PERIODS WHEN THE BUDS ARE THOROUGHLY DORMANT.

It is the purpose of this paper then, to discuss the influence of pruning, and to some extent, cultivation and thinning, on each of these four phases of hardiness. I shall discuss the subject of pruning mainly with reference to its effect on the vigor of growth. A method of pruning which is often very useful to the grower, is dehorning or cutting the trees back severely after the buds have all been killed in the winter. This throws the tree into a very vigorous and healthy growth, often causing it to continue to grow until frost. Since it requires considerable time for the buds to mature into a condition in which they are able to withstand severe cold, we would naturally conclude that such vigorous late growth would leave the buds in a more succulent condition, so that they would be more easily killed by a severe winter. If the growth is very late, and the buds are not started into growth by warm periods preceding the cold spell, buds on this vigorous new wood seem to be less hardy. In February, 1903, the fruit buds in the Missouri Experiment Station orchard having all been killed, the trees were cut back severely, except a few. It happened that with several varieties, half the trees were cut back and



No. 1. No. 2. No. 3.

Figure 1. No. 1. Tree was not cut back the spring before or the spring after the severe winter of 1904-05. No. 2. Tree was cut back both the spring before and the spring after that winter. No. 3. Tree was cut back spring after, but not spring before said winter. The dark portion represents new wood formed since that winter.

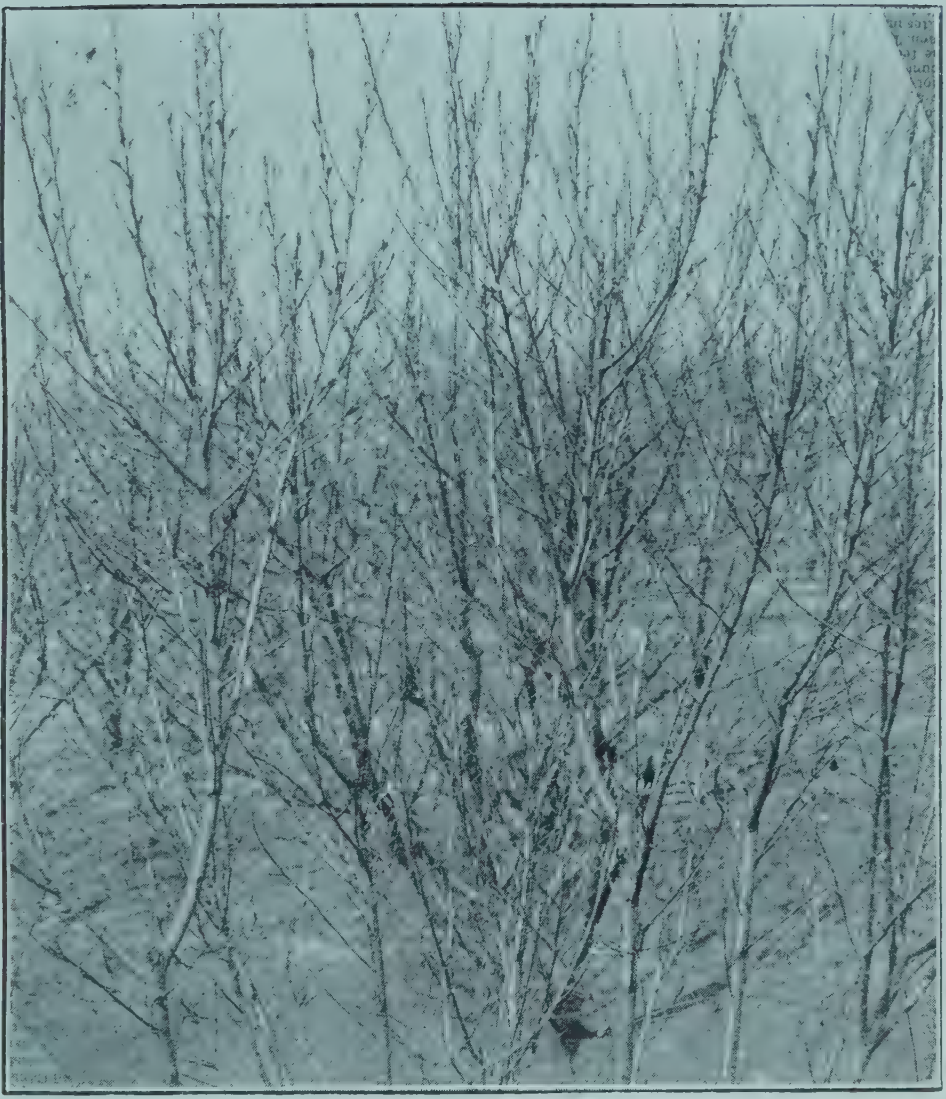


Figure 2. Old Mixon tree, spring, 1906. It was not cut back February, 1905, and had fewer buds to survive the freeze of February, 1906, than the tree in Fig. 3, that was cut back in February, 1905. The buds were badly started before the freeze.

half were not. The next winter the buds were all killed on the cut back trees of these varieties, while with the trees that were not cut back, enough buds were left to produce a fair crop of fruit, and trees in this neighborhood that were not cut back, bore even larger crops of fruit. In February, 1904, a part of the orchard was headed back severely and a part only slightly. The following winter of 1904 was so cold as to kill most of the buds in any condition, but practically all the fruit borne in the summer of 1905 was on trees that had not been cut back severely in the spring of 1904. Some of the trees not cut back, bore a fair crop of fruit. These data are not extensive enough, but they are at least suggestive, and have been partially confirmed by reports from growers in the State. Mr. John Dressel of Sappington, Missouri, reports that in the spring of 1899, he had a seven-year-old peach orchard of 300 trees in which each row was a separate variety. The trees of one-half each row, and therefore, of each variety, were headed back severely into three or four-year-old wood, while the other half was not headed back. The headed back trees, of course, made a vigorous growth the following summer. Mr. Dressel reports that without exception, only enough buds lived through the next winter to make a very slight crop on the trees that had been cut back, while on those not cut back, enough buds lived to make a very heavy crop.

This will be more noticeable in the orchards of North Missouri, where the growth is later, and the early part of the winter much colder. Of a large number of men answering questions sent out, a majority from North Missouri reported that their trees had failed to carry a crop of buds through from being dehorned too severely the previous year.

This evidence suggests that it is possible to head back so severely as to secure less hardy buds on the following summer's wood. This applies however, in Missouri, only to very severe heading back, and only to cold periods that come when the buds generally have not been started into growth by previous warm periods.

COLD PERIODS FOLLOWING WARM PERIODS.

It is known that in most of the Missouri winters, especially the southern half of the State, there are warm periods which start the buds into growth, thus making them more easily killed by the cold periods which usually come the first half of February. While a tree making a rather slow growth and going dormant rather early in the summer, may have buds that are more hardy for a steady cold winter like they would have in New York, that is not necessarily true for the average Missouri winter. In the winter of 1905-06, the buds in the Missouri Experiment Station orchard had been started previous to the low temperature of February 3, 1906. It happened that with a number of varieties, part of the trees had been cut back in the spring of 1905 severely, and a part only slightly (not enough to throw them into very vigorous growth since the wood had been badly injured by the previous severe winter.) The following table shows very definitely that the buds were much less injured on the trees that had been severely cut back.

BUDS KILLED FEBRUARY 3 BY A TEMPERATURE OF 3 DEGREES BELOW ZERO, FAHR.

Variety.	No. of buds counted.	Per cent killed.
Elberta (cut back)	879	48.5
Elberta (not cut back)	1,680	67.8
Oldmixon Free (cut back)	876	62.9
Oldmixon Free (not cut back)	1,040	78.0
Triumph (cut back)	810	30.0
Triumph (not cut back)	1,111	59.1
Lewis (cut back)	914	16.0
Lewis (not cut back)	1,347	25.7
Early Tillotson (cut back)	184	23.9
Early Tillotson (not cut back)	541	54.7
Total (cut back)	3,663	38.9
Total (not cut back)	6,369	58.7
Average per cent killed (cut back)	....	36.2
Average per cent killed (not cut back)	....	59.8

It is known that most deciduous trees have what is called a dormant or resting period; that is, a period in which, no matter what the temperature conditions are, the buds cannot be forced into growth. Since the trees that were not cut back, that is, that made the less vigorous growth, go into their resting period earlier, it would seem possible that they might finish that period earlier and thus have their buds more readily started into growth by warm periods in other winters. The following table at least suggests that such is the case. Twigs were cut December 2, and placed in water in a warm room. The table gives the number of buds started into growth that could be detected by December 21st.

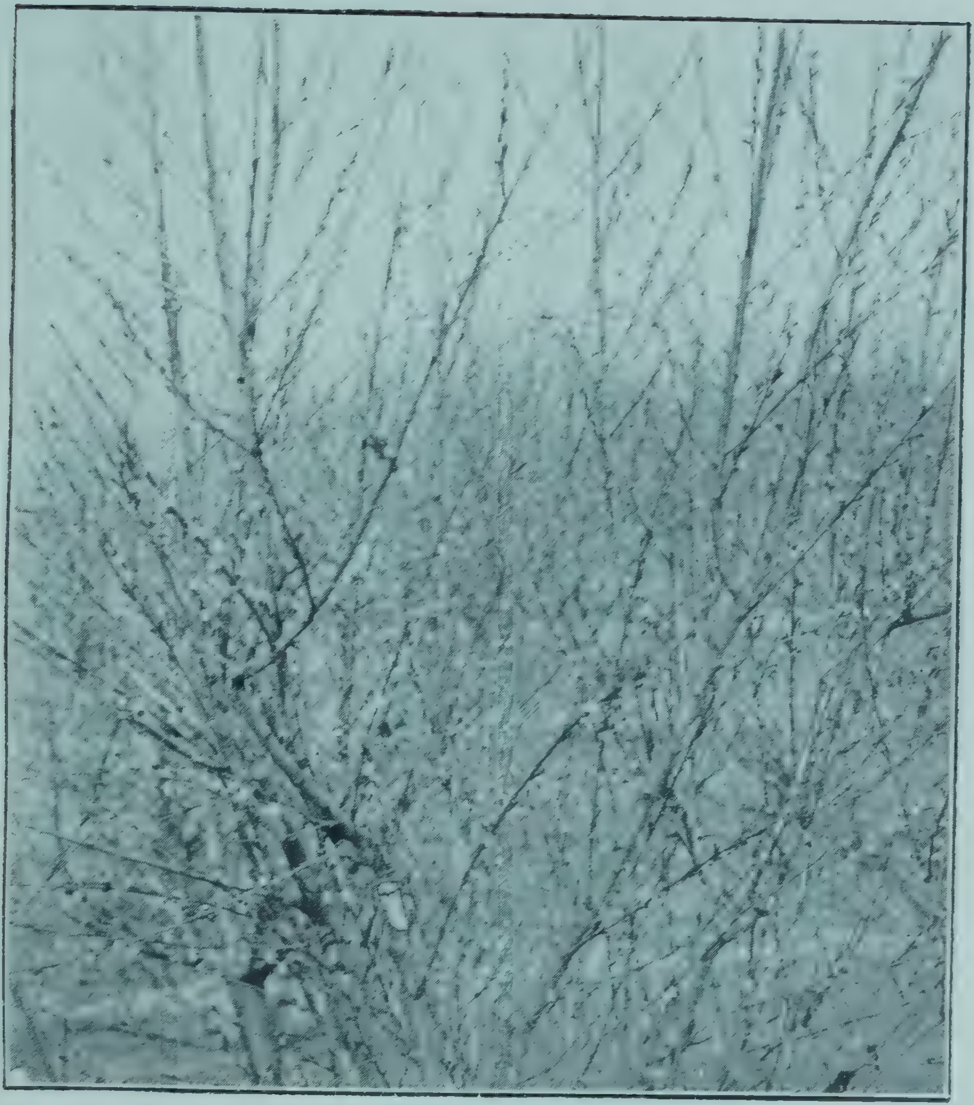


Figure 3. Old Mixon tree, spring of 1906. It was cut back in February, 1905, and more buds survived the freeze of February, 1906, than survived on the adjoining tree, Fig. 2, in February, 1905.

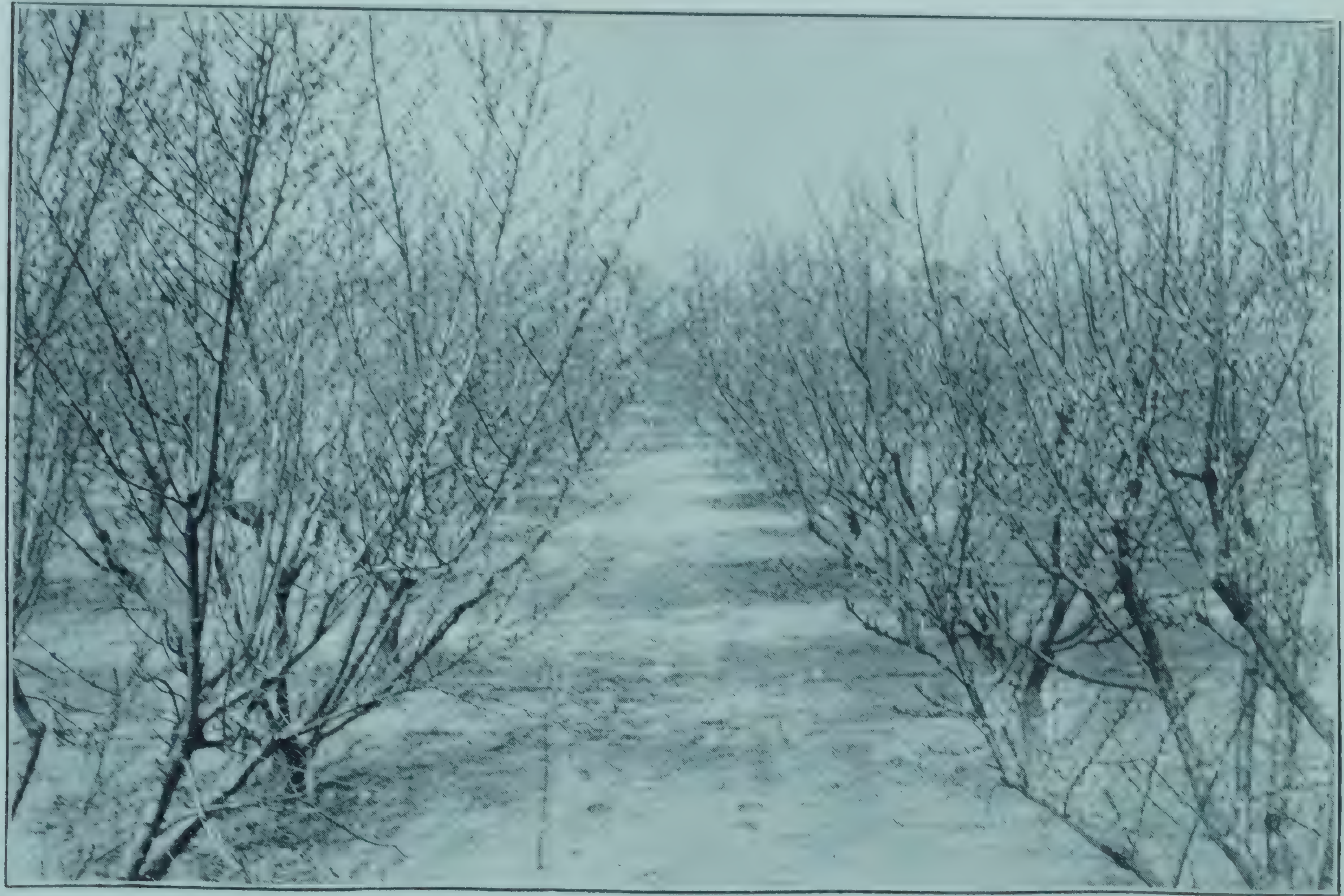


Figure 4. Elberta trees, showing amount of bloom, spring, 1906. Tree on the right was cut back spring of 1905, Tree on the left was not,

BUDS ON TWIGS TAKEN DECEMBER 2 THAT HAD STARTED BY DECEMBER 21.

Varieties.	Total No. buds examined.	No. of buds started.	Per cent. started.
Elberta	39	26	66.6
Elberta (cut back)	39	0.	
Early Tillotson	92	5.	5.4
Early Tillotson, (cut back)	69	0.	
Oldmixon Free No. 168	82	4.	4.8
Oldmixon Free (cut back)	88	22	2.

Another set of twigs was taken December 28th, and the following table gives the number of buds started into growth that could be detected by January 20th.

TWIGS TAKEN FROM TREES DECEMBER 28.

Varieties.	Total No. buds examined.	No. of buds started.	Per cent started.
Elberta	335	204	60.8
Elberta (cut back)	416	141	33.9
Lewis	235	33	14.0
Lewis (cut back)	183	12	6.5

In the spring of 1906, no trees were severely headed back in the Experiment Station orchard, but in the majority of cases those trees which had been headed back severely in the spring of 1905, continued to make a more vigorous growth during the summer of 1906, though this was not always true, for some of the trees that had been headed back bore much the heavier crop of fruit. However, twigs were taken in the winter of 1906-07, from trees that had, and trees that had not been headed back severely in the spring of 1905, and in the majority of cases the buds were less readily started into growth on the twigs from trees that had been headed back in the spring of 1905. The following summary for thousands of buds certainly indicates that a vigorous growth tends to reduce the starting of buds in the winter. Average per cent of buds started on twigs from trees making large growth equals 20.9. On twigs from trees making small growth, equals 31.2. Some of the twigs were taken as early as November 23rd, and, of course, in those cases very few buds were started. If we consider only buds on twigs taken as late as December 22nd, we have:

For trees making large growth......28.3 started.
For trees making smaller growth.....48.6 started.

Taking only those varieties which on trees had 60 per cent of buds started, and therefore may be considered to have finished their resting period, we have as an average on trees making large growth, 43.8 per cent of buds started; on trees making smaller growth, 83.4 per cent of buds started.

This table certainly tends to confirm the evidence of the previous one, that trees making a late vigorous growth are later in finishing their resting period, and are therefore in less danger from cold following a warm period in December or January, that starts the buds.

The following table gives the percentage of buds killed on the trees making more and less vigorous growth in February of 1907; and certainly confirms the above conclusions.

TABLE GIVING THE PERCENTAGE OF BUDS KILLED IN FEBRUARY, 1907, ON TREES THAT WERE, AND TREES THAT WERE NOT HEADED BACK IN THE SPRING OF 1905.

Variety.	No. of buds counted.	Per cent of buds dead.
Triumph	642	44.8
Triumph (cut back)	700	33.1
Bell's October	740	56.9
Bell's October (cut back)	868	40.8
Hubert Cling	772	67.6
Hubert Cling (cut back)	586	59.5
Lewis	162	42.5
Lewis (cut back)	278	29.5
Oldmixon Cling	1,442	44.4
Oldmixon Cling (cut back)	650	34.9
Smock	804	61.7
Smock (cut back)	487	50.2
Oldmixon Free	504	90.8
Oldmixon Free (cut back)	516	86.4
Elberta	409	59.9
Elberta (cut back)	687	63.8
Average		58.6
Average (cut back)		49.7

Elberta cut back had the greater percentage of buds killed and it also had the greater percentage of buds that could be started by December 2. This is probably due to the fact that it bore the heavier crop the summer before and was thus weakened, so that its resting period ended earlier.

Since buds on trees that have made a rather vigorous growth the previous summer, are less readily started by warm periods in winter, it will be of interest to examine the Missouri Weather Reports, and see whether the buds in Missouri are more likely to be killed by cold periods following warm periods that start the buds, or by very low temperatures in steadily cold winters with no warm days to start the buds. The following table shows the minimum temperatures at various points in Missouri since the winter of 1895-96.

MEAN TEMPERATURES FOR POINTS IN NORTH AND IN SOUTH MISSOURI.

Winter.	Columbia.		Oregon.		Olden.		Neosho.	
	M. T.	Date.	M. T.	Date.	M. T.	Date.	M. T.	Date.
1895–1896	–2	Jan. 4	–4	Jan. 3	–4	Dec. 4	–2	Dec. 3.
1896–1897	–4	Jan. 25	–9	Jan. 24	–3	Jan. 27	–4	Jan. 27.
1897–1898	–2	Feb. 2	–4	Dec. 18	–4	Feb. 3	–6	Feb. 3.
1898–1899	–26	Feb. 12	–26	Feb. 12	–29	Feb. 12	–30	Feb. 12.
1899–1900	–6	Dec. 15	–6	Feb. 17	–10	Feb. 17	–4	Feb. 17.
1900–1901	0	Jan. 1	–3	Feb. 10	–5	Feb. 23	–9	Jan. 1.
1901–1902	–23	Dec. 20	–15	Feb. 27	–10	Dec. 20	–7	Dec. 20.
1902–1903	–15	Feb. 17	–15	Feb. 17	–8	Feb. 17	–9	Feb. 17.
1903–1904	–14	Jan. 29	–15	Jan. 26	–5	Jan. 26	–5	Jan. 26.
1904–1905	–25	Feb. 13	–27	Feb. 13	–18	Feb. 17	–29	Feb. 13.
1905–1906	–3	Feb. 3	–3	Feb. 3	–7	Feb. 6	–10	Feb. 5.
1906–1907	–6	Feb. 5	–12	Feb. 5	–3	Jan. 26	–6	Feb. 5.

In the winter, 1905-06, when there had been no warm days to start the buds only a small percentage of buds were killed in the Missouri Experiment Station orchard by a temperature of -12 on trees that had been headed back the previous spring as severely as it will ever be necessary to head them back. Yet, reference to the above table will show that since 1895, there have been only two winters at Olden and Neosho when the minimum temperature reached -12, though at Oregon and Columbia there were a number of other winters when the temperature went lower than -12, and was probably low enough to kill the buds on trees that had grown late into autumn. If the buds were killed in South Missouri, in any other winter than the two referred to, they must have been previously started into growth by warm periods. As previously mentioned, there were at Columbia, in December and January of 1905-06, enough warm days to start the buds into considerable growth. There were in Columbia, in those two months of that year, 28 days with a mean temperature above 35, 14 days with a mean temperature above 40, and 3 days with a mean temperature above 45. The following table gives similar data for Columbia, Oregon, Olden and Neosho for the past 10 winters.

TABLE SHOWING THE NUMBER OF WARM DAYS AT DIFFERENT POINTS IN MISSOURI IN DECEMBER AND JANUARY FOR EACH YEAR, FROM 1897 TO 1908.

Mean temperature. Year.	Columbia. Dec. and Jan.	Oregon. Dec. and Jan.	Olden. Dec. and Jan.	Neosho. Dec. and Jan.
Days 35 F. or above, 1897–98..	25	13	32	38
Days 40 F. or above, 1897–98...	11	5	17	22
Days 45 F. or above, 1897–98...	4	1	9	10
Days 35 F. or above, 1898–99...	23	15	31	33
Days 40 F. or above, 1898–99...	11	11	8	25
Days 45 F. or above, 1898–99...	3	0	9	10
Days 35 F. or above, 1899–00...	29	30	37	35
Days 40 F. or above, 1899–00...	22	16	26	26
Days 45 F. or above, 1899–00...	10	3	13	20
Days 35 F. or above, 1900–01...	33	25	45	45
Days 40 F. or above, 1900–01...	16	14	29	30
Days 45 F. or above, 1900–01...	9	5	16	15
Days 35 F. or above, 1901–02...	23	19	29	36
Days 40 F. or above, 1901–02...	10	10	21	27
Days 45 F. or above, 1901–02...	4	2	11	10
Days 35 F. or above, 1902–03...	20	13	34	33
Days 40 F. or above, 1902–03...	9	2	16	17
Days 45 F. or above, 1902–03...	6	1	10	8
Days 35 F. or above, 1903–04...	18	14	34	37
Days 40 F. or above, 1903–04...	7	2	15	20
Days 45 F. or above, 1903–04...	3	0	6	7
Days 35 F. or above, 1904–05...	13	12	25	23
Days 40 F. or above, 1904-05...	8	6	15	17
Days 45 F. or above., 1904–05..	6	2	11	12
Days 35 F. or above, 1905–06...	28	20	37	40
Days 40 F. or above, 1905–06...	14	5	20	15
Days 45 F. or above, 1905–06...	3	1	5	11
Days 35 F. or above, 1906–07...	27	14	41	46
Days 40 F. or above, 1906–07...	21	8	34	35
Days 45 F. or above, 1906-07...	14	2	15	24
Days 35 F. or above, 1907-08...	28	18	42	46
Days 40 F. or above, 1907-08...	10	7	23	28
Days 45 F. or above, 1907-08...	7	2	12	12

It will be seen that, in every year in the ten, there were at Olden and Neosho more days above 35, above 40, and above 45 than there were at Columbia in that year. Of course the number of days with

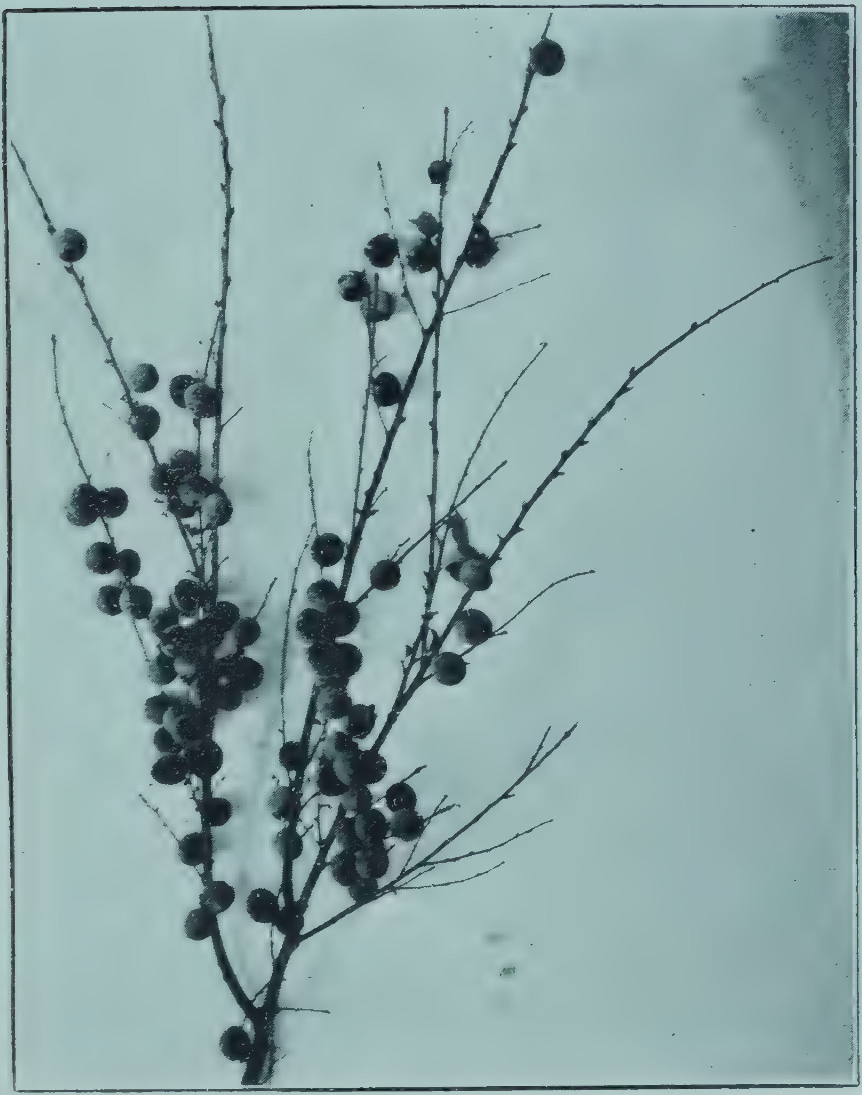


Figure 5. Branch from peach tree, summer of 1904. Wood of 1904 is cut off. Buds on the bare twigs were killed by the preceding winter. Only buds at base of whips survived.

a high mean temperature doesn't alone determine the amount the buds are likely to swell for the intensity of the sunlight is not here considered. It has been shown at this station that on very bright days the temperature of the twigs may be 15 degrees above that of the air. Yet since the number of warm days is so large in South Missouri, it is certainly very probable that on trees which end their resting period by the first part of December the buds are swollen some almost every year. It will also be seen that at Oregon, in North Missouri, there have in the ten years, been only two winters with as many warm days in those two months as we had at Columbia in the winter of 1905-06.

The above data would certainly indicate, that in South Missouri, the probability of getting the buds through the winter was greater on trees that have made a rather vigorous growth the previous summer, while in North Missouri, possibly greater care should be taken to have the trees thoroughly dormant in time for the buds to be ready for the cold periods in winter.

Before drawing conclusions as to the condition of the tree which favors the greatest hardiness for a climate like that of Missouri, it will be of interest to observe the location of the hardiest buds on the twigs. The following table is for data taken in the spring of 1906.

TABLE SHOWING LOCATION OF HARDIEST BUDS, WINTER OF 1905-06.

Variety.	Buds on short twigs.	Per cent. killed.	Buds on terminals of twigs.	Per cent. killed.	Buds on bases of twigs.	Per cent. killed.
Elberta	640	74.5	329	76.6	433	55.9
Elberta (cut back)	....	....	466	56.0	413	40.0
Oldmixon Free	440	87.5	217	79.3	258	65.2
Oldmixon Free (cut back)	....	....	546	65.0	330	59.4
Triumph	553	57.3	184	71.2	281	41.6
Triumph (cut back)	....	....	485	36.1	325	20.9
Lewis	461	31.5	325	37.8	369	13.6
Lewis (cut back)	....	....	487	20.7	427	12.9
Early Tillotson	470	58.7	....	....	....	....
Early Tillotson (cut back)	....	....	104	26.0	80	21.3
Average	....	61.9	62.2	62.2	....	44.0
Average (cut back)	....	....	....	40.7	....	30.9

It is plain for a year like this, that the hardiest buds are at the base of the twigs. This is important in the case of trees that have been rather severely headed back, or in the case of young trees; for in either case, if the tree has been left to form a very dense head, the first leaves formed in the summer will be put in the shade as the tree grows, and will thus fall off; and therefore the only buds formed will be on the terminal parts of the twigs. An illustration of this was seen in the Oldmixon Free tree in the station orchard in the season of 1907.

In the spring of 1907, some of the trees in the station orchard were headed back with special reference to the formation of spreading heads, while others were headed in more closely to encourage the formation of dense heads. The following table gives the results of the bud formation on these trees:

Tree.	Total number buds.	Per cent. on base of whips.
Elberta, open head	23,086	39.1
Elberta, open head	7,468	40.3
Elberta, dense head	5,344	30.
Elberta, dense head	9,609	33.2
Oldmixon Free, open head	33,064	28.1
Oldmixon Free, open head	22,245	35.8
Oldmixon free, dense head	7,818	21 11
Oldmixon Free, dense head	16,013	22.4

It is very plain, then, that when a tree is making a vigorous growth, it should be trained to a spreading open head to encourage the formation of better fruit buds and the location of the buds where they are most hardy. Besides this, with the spreading heads, healthy twigs, bearing fruit buds will be formed lower down on the branches, and thus we can cut back more severely each year, and still leave plenty of fruit buds for the season's crop.

The wisest system of pruning, it would seem then, would be to head back severely enough to keep the tree in a good, vigorous state of growth, but to keep the center cut to let in the sunlight, to encourage the formation of buds, well down towards the base of the tree. The heading back should be more severe farther south where it is more important that the buds should be kept dormant during the winter.

SPRING FROSTS AT BLOOMING TIME.

Whether or not prolonging the resting period by throwing the tree into rather vigorous growth will affect the blooming time of the peach, and therefore its ability to resist spring frosts, we have not enough data to say conclusively.

The position of the buds on the twigs, however, does seem to

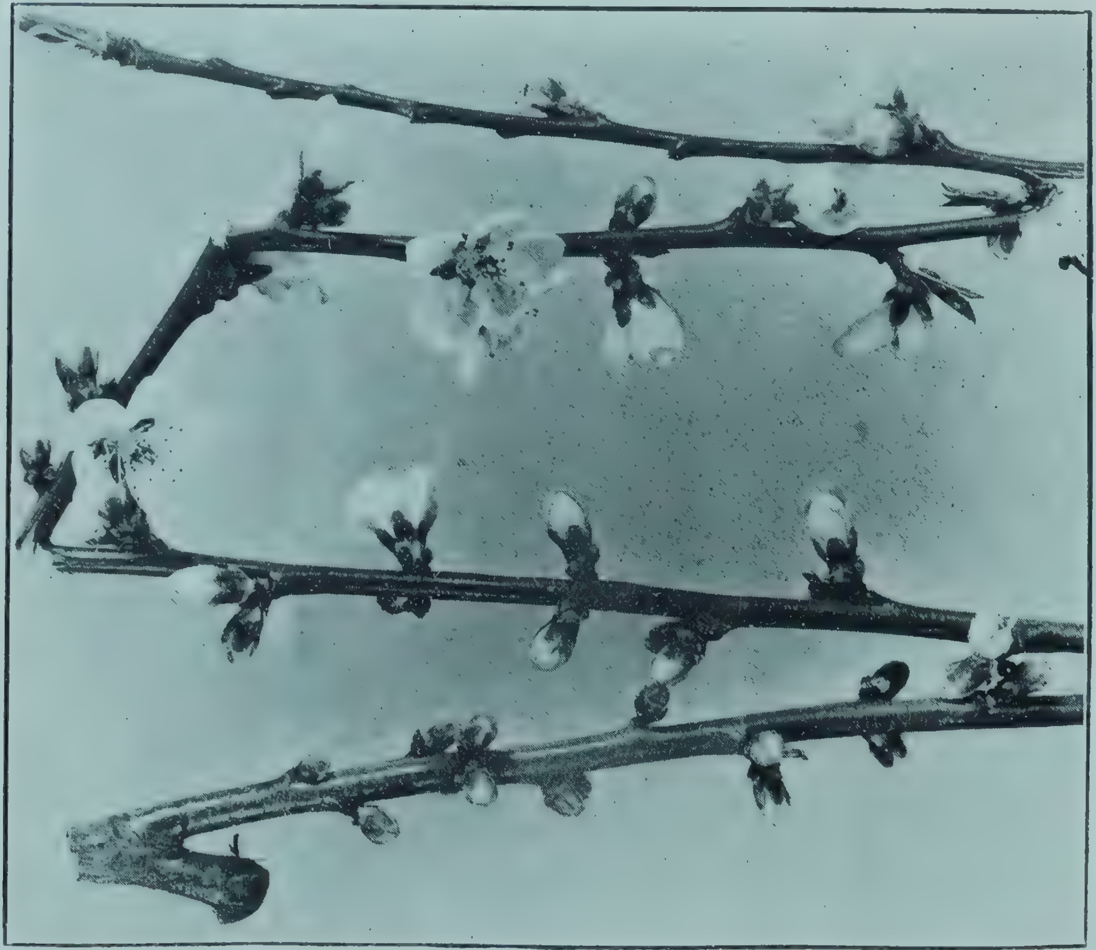


Figure 6. Peach twigs, showing that the blossoms near the base come out more slowly than those near the tip.

influence the hardiness of the blossoms. We have seen that the buds at the base of the whips are more slowly started in the winter. They are also the last to start in the spring. It is probably generally known that a peach flower unopened will stand considerably more cold than one fully open. At least, that is true in Central Missouri, as the following table will show:

Variety.	Buds open.		Buds unopened.	
	No. of buds.	Percentage killed.	No. of buds.	Percentage killed.
Oldmixon Free	253	99.9	30	36.6
Oldmixon Free	326	25.4	241	15.3
Elberta	347	24.4	85	7.1
Elberta	309	51.13	26	1.1

Nearly all the unopened buds were on the base of the whips. The following table shows that a very much larger percentage of the blossoms were killed on the tips than on the base:

Variety.	Butts.		Tips.	
	Buds.	Per cent. killed.	Buds.	Per cent. killed.
Oldmixon, 170	159	70.44	363	84.39
Oldmixon, 169	426	11.03	598	41.97
Oldmixon, 152	648	15.12	828	67.23
Elberta, 133	374	19.78	603	44.92
Elberta, 161	356	35.1	319	82.4
Elberta, 141	121	38.	205	69.2
Elberta, 160	163	52.1	143	71.3
Crawford's Early, 29	95	5.26	155	25.16
Ortiz, 147	623	46.70	553	55.50
Sneed, 55	503	14.25	492	65.44
Sneed, 56	354	45.48	413	53.75
Sneed, 155	174	2.3	252	12.3
Sneed	251	23.1	186	50.5
Kalamazoo, 19	579	32.29	529	54.23
Family Favorite	483	26.70	431	63.80
Family Favorite	256	22.22	192	66.14
Golden Gate, 26	129	85.2	72	50.
Dewey Cling, 121	106	14.1	109	73.4
Dewey cling	171	12.2	111	17.1
Elberta Seedling, 88	151	5.9	216	73.
Elberta Seedling	1,850	11.	980	16.3
Connet in high ground	395	11.1	507	43.1
Connet in low ground	446	9.2	....	....

It will be seen that in practically every case a much smaller percentage of buds was killed at the base of the whips. This being true, if a tree is shaped so that only a very few buds are formed at the base of the whips, we would expect that there would be greater danger from spring frosts. This was found to be true in the spring of 1908. In North Missouri that spring, little damage was done by the very late frost on April 30th. The injury was done by the frost of April 3rd, when the trees were in bloom. The writer visited many peach orchards along the Missouri river from McBaine to Kansas City. In practically every orchard where there were young and old trees, the old trees had the better crop left. And in practically every case where there were dehorned trees, the crop was lighter, and in some cases there was no crop on the dehorned trees; while the trees not dehorned bore a heavy crop.

The dehorning was done in such a way that the tree had a dense head, and the young trees left alone in this rich soil also have a dense head, so that in each case the only buds formed were on the terminal half of the whips of new growth, where they most quickly come into bloom in the spring. Often on the southwest side of the trees where the light would penetrate deeper, there was a good set of fruit when the remainder of the tree had little or none. The same was often seen to be true of a limb projecting out beyond the others.

While the old trees bore the heavier crops, it must be remembered that these trees had not borne the summer before, and in this excellent fruit soil made a good healthy growth. Very weak, devitalized trees, generally had little or no fruit left, because in this case the trees bloomed earlier than the rest.

Generally, there was fruit enough on the dehorned trees, for in most cases the crop was too heavy on the old trees.

Open heads during the previous summer when the buds are forming with a fairly vigorous growth, then, seems to be the condition that favors the greatest hardiness of blossoms. This is because at a spring frost more of them are likely to be unopened.

SPRING FROSTS AFTER THE FRUIT HAS SET.

In South Missouri in 1908, especially at Koshkonong, the greater injury was done by the frosts on April 30th, when the fruit had reached considerable size. The writer visited orchards in South Missouri at Goodman, Koshkonong and Brandsville. Of course, elevation was the most important determining feature, but

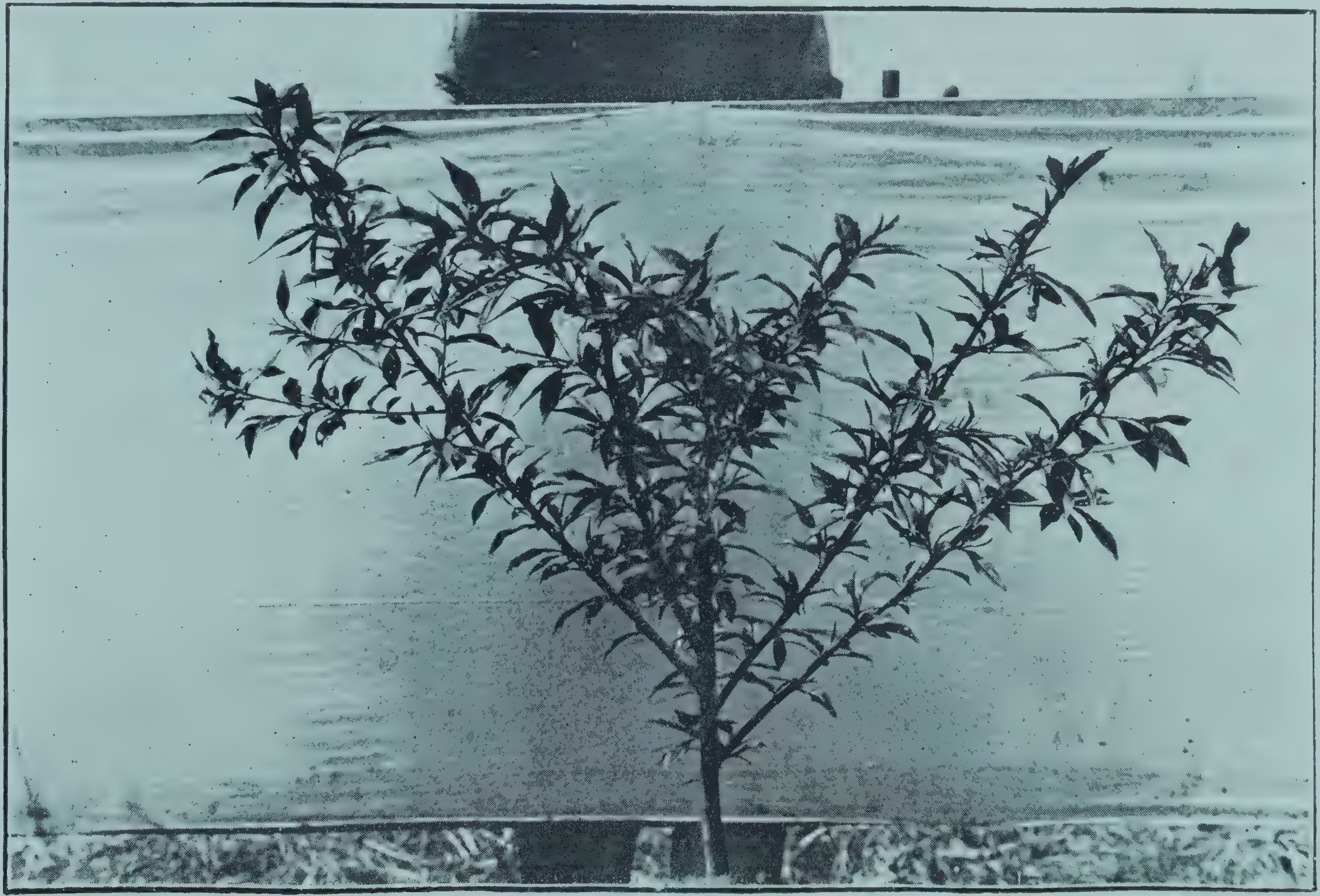


Figure 7. Well pruned one-year-old tree.

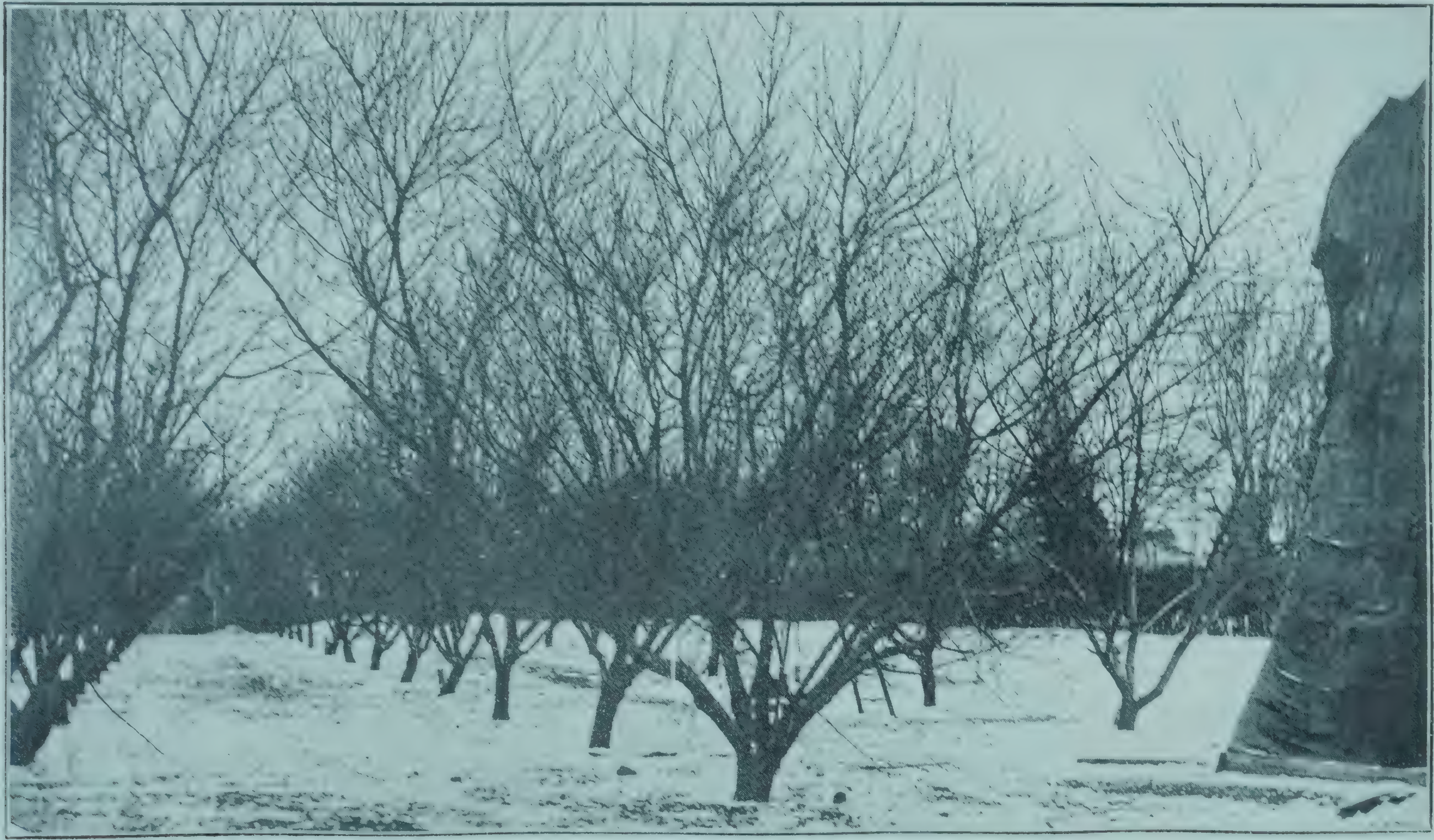


Figure 8. Good open-headed tree in winter.

where the land was high enough for the fruit to escape partial injury, the crop was larger on young trees, or on trees that, for other reasons, were making vigorous growth. Of a large number of persons to whom questions were sent a large majority of those in the South Missouri section, where the frost of April 30th did great injury, reported that they had the most fruit on young trees. The writer went over the orchard of Mr. Paynter of Koshkonong, and found that weak trees, even under the most favorable conditions of elevation, had little or no fruit left. In uncultivated, rocky hills there was no fruit, when cultivated trees even lower down the hill had fruit. In a young orchard of Hitt Sons at Koshkonong, there was a pretty good crop, while in an old one, that so far as one could tell was as favorably located with reference to elevation, had no fruit left.

Just how vigorous wood growth helped the young peaches to resist the freeze, it is not easy to explain. It is known that peaches on vigorous trees are later in maturing than peaches on weak trees. It may be that the reason the fruit killed worse on weaker trees was because it was further along in its development than that on vigorous trees. Fruit of early varieties, like Sneed and Alexander, was practically all that was killed in the Missouri Experiment Station orchard. This would suggest that the further along in its development the peach is, the more easily it is killed by frosts. But this can not be conclusive for varietal differences enter into consideration. However, very few or no fruits of the Elberta variety were killed at Columbia, or so far as my knowledge goes, in any part of North Missouri, by this late frost, yet the temperature in North Missouri was generally lower than at Koshkonong, or most other peach sections of South Missouri, as the following table will show:

Station.	Date. April.	Temp.	Date. April.	Temp.
Avalon	2	22	30	29
Brunswick	2	25	30	29
Columbia	3	24	30	28
Darksville	2	24	30	32
Hannibal	3	24	30	29
Jefferson City	3	23	30	30
Keokuk, Iowa	2	24	30	30
Lexington	2	25	30	30
Louisiana	3	19	30	26
Marshall	3	24	30	27

Station.	Date. April.	Temp.	Date. April.	Temp.
Mexico	2	25	30	28
Oakfield	2	25	30	31
St. Charles	2	23	30	30
Steffenville	3	23	30	27
Sublett	3	21	30	23
Warrenton	3	24	30	29
Belle	3	20	30	29
Birchtree	3	26	30	32
Dean	....	....	....	....
De Soto	....	....	....	....
Doniphan	3	28	30	32
Farmington	....	....	....	....
Goodland	3	20	30	28
Houston	3	22	30	28
Greenville	3	28	30	33
Ironton	3	21	30	30
Koshkonong	3	28	30	32
Lebanon	3	24	30	29
Mountain Grove	3	25	30	29
Mount Vernon	3	27	30	28
Neosho	3	29	30	28
New Palestine	3	25	30	31
Olden	3	25	30	28
Rolla	3	24	30	30
Springfield	2	28	30	33
Versailles	3	21	30	30
Willow Springs	3	26	30	30
Atchison, Kans	3	21	30	30
Bethany	2	21	30	25
Conception	2	18	30	29
Grant City	2	18	30	27
Kidder	2	22	30	34
Maryville	2	18	30	27
Oregon	2	19	30	27
Trenton	2	22	30	28
Unionville	3	19	30	25

The peaches in South Missouri at the time of the frost were much larger than in North Missouri, and since they were badly killed by a higher temperature than obtained in North Missouri, it would certainly indicate that the further along in its development the peach is, the worse it kills. It is certainly true at Columbia, that the peach blossom will stand very much more frost than the young fruit after the flower parts have broken off.

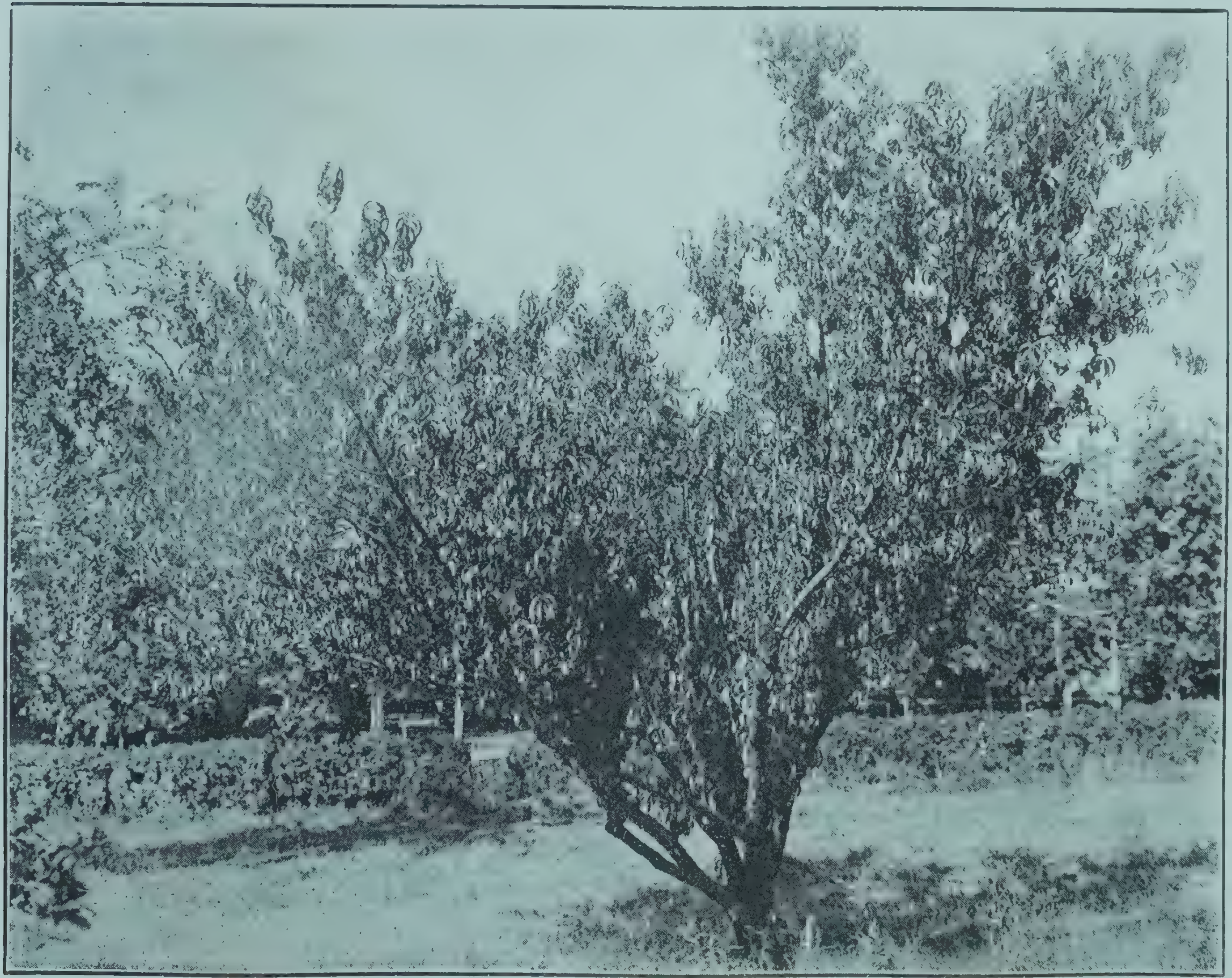


Figure 9. Open-headed tree, showing that healthy twigs are to be found down to the forks of the tree.

Whether or not the young peaches on the terminal portion of the twigs were killed worse than those at the base of the twigs, I cannot say conclusively. The fruit, however, was borne very largely at the base of the twigs in South Missouri. The frost at blooming time, though, may have killed the blossoms at the terminal portion of the twigs.

To summarize: If the buds are injured by a freeze, coming before any buds have been started by a warm period, the condition that favors the greatest hardiness, is to have the tree mature reasonably early the previous season, and to have the buds set well down at the base of the whips, and on short spurs coming out from two-year old wood. If the buds are killed after having been previously started by a warm period, the condition that favors the greatest hardiness is secured by having the tree grow well up toward the end of the season so as to prolong the resting period, and thus reduce the amount of growth the buds may make on warm days, and to have the heads of the trees open so that buds may form well down to the base of the whips. If the blossoms are killed by spring frosts, the condition that favors the greatest hardiness is secured by having the tree reasonably vigorous with an open head and buds formed well down to the base of the whips and on short twigs and spurs from the older wood. If the young fruit is killed by very late frosts, the condition that favors the greatest hardiness is secured by having the trees in as vigorous a condition of growth as a healthy five or six-year old tree generally makes. The best system of pruning, then, would seem to be to keep the heads of the trees open, and the ends of the branches shortened back some each year, enough to keep the tree in a reasonably vigorous state of growth. Trees in South Missouri will need considerable of this heading back, especially as the trees grow older. In the northern half of the State, and especially in a section where the trees make the most growth, like the hill land around Kansas City, the heading back will have to be done more cautiously for fear of throwing the tree into too vigorous growth. Some heading back should be done, however, each year. The importance of having an open head will be greater in the northern half of the State than in the southern, so far as the hardiness of the buds is concerned, especially if we do any heading back.

EFFECT OF CULTIVATION OF THE ORCHARD ON HARDINESS.

We have not been able to do much work on the effect of cultivation on hardiness, but reasoning from analogy, and from what observations we have made, we would conclude that the influence of cultivation would be very much the same as that of pruning. Further north, cultivation late in the season, especially when the trees are young, would tend to keep them growing too late, and thus the buds would not be well matured for winter. Reasonable cultivation, especially from Central Missouri south, would tend to keep the trees growing late enough that the buds would not be so badly started by warm periods in winter. It would also keep trees growing vigorously enough, especially if accompanied with good pruning; that there would be less danger from spring frosts coming after the fruit has reached some size. Cultivation seems to be very important in the Ozarks to keep the trees in a steady condition of growth. So far as the condition of the tree, and the hardiness of the buds are concerned, cultivation does not seem to be so important in the deep loess soil, along the Missouri river hills. Of course, the relation of cultivation to the control of curculio and brown rot does not concern us in this paper.

RELATION OF THINNING FRUIT TO HARDINESS.

A number of trees in the Missouri Experiment Station orchard had their fruit thinned on one side of the tree so that no fruits were closer to one another than five or six inches. The other side was left with a very heavy crop. This was done in June, 1906. The following table gives the percentage of buds killed by the slight cold the following winter:

Variety.	No. of buds counted.	Per cent. of buds killed.
Seedling, side fruit was off	1,529	18.5
Seedling, side fruit was not off	1,657	58.9
Elberta Seedling, side fruit was off	1,020	31.6
Elberta Seedling, side fruit was not off	1,146	36.7
Old Mixon Cling, fruit thinned	1,442	44.5
Old Mixon Cling, fruit not thinned	1,149	53.4
Poole's Favorite, thinned side	818	41.7
Poole's Favorite, side not thinned	807	52.8
Poole's Favorite, No. 2, thinned side	1,563	40.9
Poole's Favorite, No. 2, side not thinned	1,200	55.4
Average (thinned)		35.4
Average (not thinned)		51.4

This table certainly indicates that thinning the fruit may greatly influence the hardiness of the buds. From further data that we have, however, it seems that the only influence thinning has, is through its effect on the resting period. The bending of

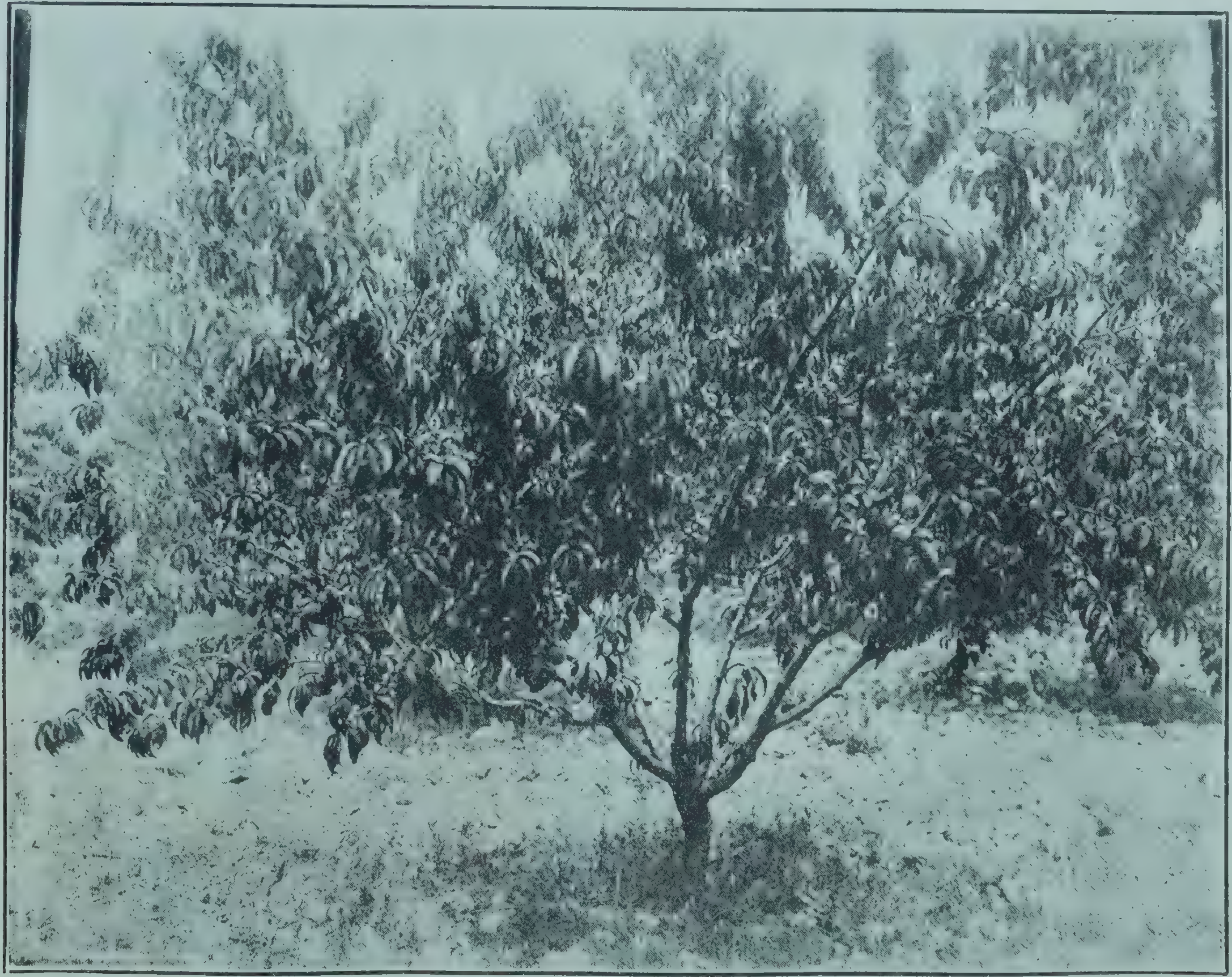


Figure 10. Good open head. Orchard of W. C. Paynter, Koshkonong, Missouri.

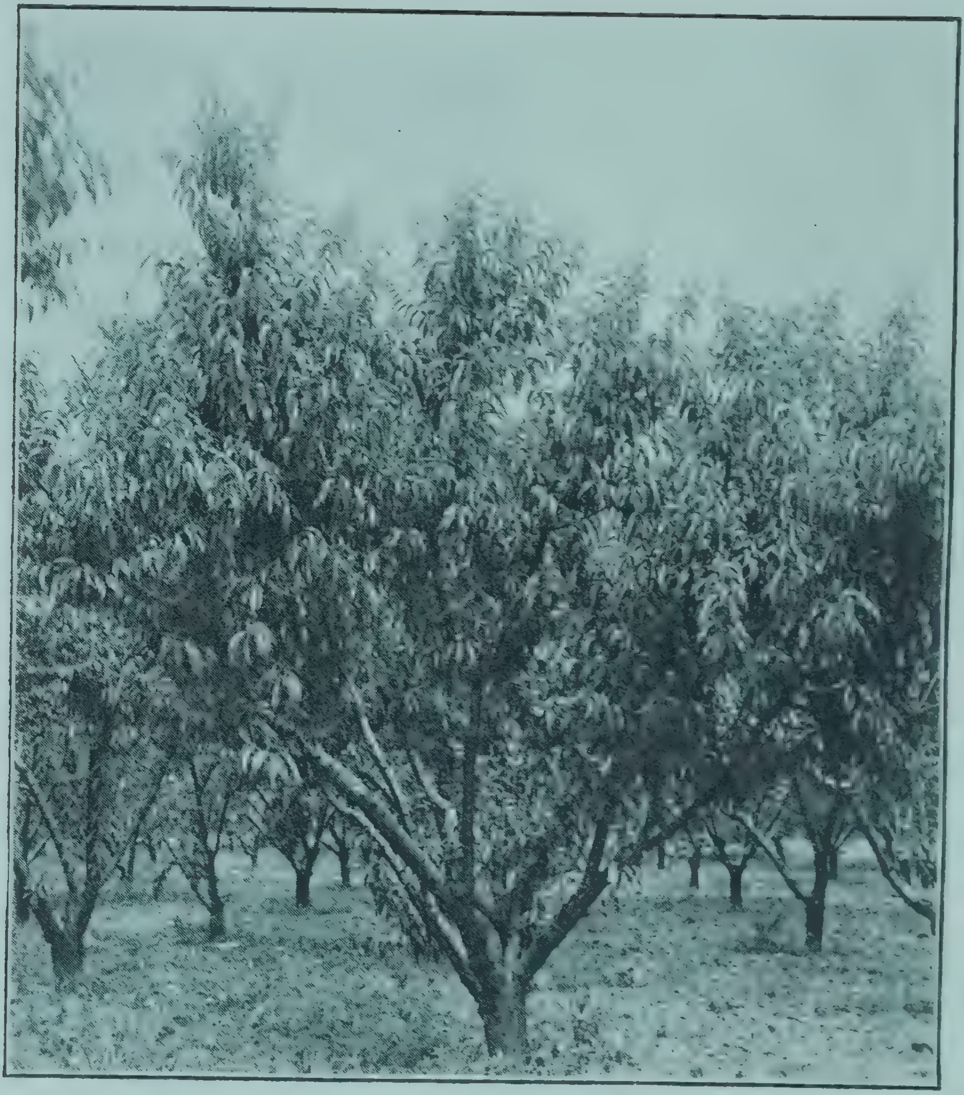


Figure 11. Early summer growth on open-headed tree cut back severely in late winter.

the branches and the twigs under the weight of fruit would interfere with the upward movement of sap, and thus cause the tree to go dormant earlier, and end its resting period earlier.

HARDINESS OF VARIETIES.

The hardiest varieties in New York or Canada may be far from the hardiest in Missouri. A variety may be hardy in the north, partly because of its habit of maturing early, or the buds, when thoroughly dormant, may be more hardy than the buds of other varieties equally dormant. In either case, the variety may not be the most hardy in South Missouri, where the most serious problem is to keep the buds from swelling during the warm days they nearly always have, preceding the cold periods. Thus, Fitzgerald is a very hardy peach in the north, but does not seem to be more hardy than Elberta in the southern part of Missouri. For years when the buds have been started by warm days previous to the cold wave, the hardiest peaches seem to be the green twig varieties and the Chinese Cling and Hill's Chili types, as the following tables will indicate:

Variety.	Per cent. of buds killed in 1905-06.	Per cent. of buds started by Dec. 12, 1906.	Per cent. of buds started by Dec. 22, 1906.
Hills Chili Type.			
Hills Chili	53.0	5.2	No data.
Lewis	25.9	0.0	39.0
Early Michigan	32.9	5.7	42.4
Average	39.7	3.6	40.7
Chinese Cling Type.			
Chinese Cling	30.7	0.0	0.0
General Lee	46.5	0.0	0.5
Sneed	41.4	0.0	8.0
Carman	41.9	No data.	25.0
Connett	Not more than 40	0.0	0.0
Family Favorite	61.0	0.0	7.0
Elberta	67.8	No data.	56.0
Thurber	69.1	No data.	No data.
Average	51.0	0.0	13.0
Average (excluding Elberta and Thurber)	44.3	0.0	6.7
Green Twig Varieties.			
Snow	42.0	0.0	12.0
Ortiz	57.1	0.0	5.4
Average	50.6	0.0	8.7

SOME COMMON VARIETIES OF THE PERSIAN RACE.

Variety.	Per cent. of buds killed in 1905-06.	Per cent. of buds started by Dec. 12, 1906.	Per cent. of buds started by Dec. 22, 1906.
Heath Cling Type.			
Heath Cling	81.6	17.5	86.0
Dewey Cling	74.8	36.7	88.0
Hubert Cling	77.2	27.4	85.0
Ringold	83.0	30.0	88.0
Average	79.1	27.9	86.7
Others of Persian Race.			
Elberta	67.8	No data.	56.0
Crawford Early	64.1	No data.	54.1
Crawford Late	90.2	No data.	59.0
Oldmixon Free	78.0	No data.	98.0
Foster	87.0	No data.	83.0
Crosby	60.9	22.8	90.0
Susquehanna	96.9	10.0	65.0
Wheatland	95.4	No data.	86.0
Golden Gate	89.7	17.7	58.0
Triumph	59.1	0.0	7.5
Average	78.9	12.6	65.7

It will be seen that for such years the hardiness is largely determined by the time the trees end their resting periods. The Hills Chili and green twig types are hardy for any kind of winter.

In case of spring frosts at blooming time, the large flowered varieties seemed uniformly to be the most hardy, probably because the petals usually remained closed over the pistils longer.

In case of spring frosts, after the fruit has reached considerable size, no determining factor has been found. Curiously enough, Elberta seemed to resist such a frost, as well as most other varieties, or better.

Much remains to be done along this line, but one fact, at least, is evident. We must know the peach tree as it grows in Missouri. We may profit to a considerable extent by the experience of men in other sections, but only along with an exact knowledge of the habits of the tree, as influenced by Missouri's soil and climate.

Because a method of care insures the greatest hardiness in Michigan or Canada, or because a variety is most hardy there, is little indication that such will be true in Missouri, especially in South Missouri.

The Station wishes to co-operate with the growers of the State along this line, and requests them to write us their experiences.

DISCUSSION.

Mr. Darsche—Was there any difference in the sides of the tree?

Mr. Chandler—Yes, very much, of course; so we tried to strike an average by counting the same number of buds on each corner of the tree.

Mr. Darsche—What per cent of Elberta was killed?

Mr. Chandler—About 75 per cent.

Mr. Darsche—Is the Salway hardier than the Elberta?

Mr. Chandler—Yes, it has been with us.

Mr. Darsche—How did the Crosby run for hardiness?

Mr. Chandler—The Crosby ran among the more hardy varieties. The hardiest varieties we have are, first, the Lewis, and, next, the Triumph.

Mr. Todd—How long do you wait after fruit is taken off before you cut back?

Mr. Chandler—Generally cut back in February, after the February freeze.

Mr. Dutcher—Cutting back in February is said to be very beneficial for next year.

Mr. Chandler—If buds are killed you can cut back as soon as you wish.

Mr. Wilson: Referring especially to Northwest Missouri, the fruit has been more severely injured in the middle of the winter, than late in the winter, although we had several peaches killed last year in the spring. We frequently have a cold spell along before Christmas, or just after, then a period of warm weather. During this period of warm weather the buds start to grow and the next freeze kills them.

Mr. Chandler—As I said, the matter of buds maturing will have a considerable effect upon the hardiness of the peach, especially in North Missouri, and when the freezes come early. The buds gradually become more hardy after leaf-fall till January, at least.

Mr. Stark—Peach growing, to a large extent, depends a great deal upon this early or late maturing. This is especially true of Southeast Missouri. In this connection, the influence of slope is brought up. Peaches on the north slope are less apt to swell their buds than the peaches on south slope.

Mr. Wilson—Peaches in Northwest Missouri are killed just the same along the north slope as along the south slope. It doesn't seem to make much difference up there.

Prof. Emerson—What explanation have you of the fact that buds at the base of the twig are not so often killed? Are they still in the resting stage?

Mr. Chandler—My guess as to the explanation of the fact, is that they start more slowly, because the plant food goes to the buds, at the tips of the twigs, first.

NEW VERSUS OLD METHODS OF PACKING AND MARKETING APPLES.

(By C. W. Wilmeroth.)

In accepting an invitation to meet you today, I find myself in the same position as the young man, who, when he was 20 years of age, was sure he knew twice as much as his father. At 30, he decided he and his father knew equally as much as each other, and at 40, he was positive his father was much the wiser of the two; and after spending 30 years of my life in the fruit trade, many times I am inclined to think I knew very little about the apple business at all; especially is this apparent lack of good judgment forcibly brought to my mind, when I recall the splendid fizzle we all made of the apple deal of 1907. It is one thing to be nicely settled in convention, as we are at present, and tell each other how apples should be packed and graded, and quite another thing to go into the field and buy these apples, and pack them according to the printed rules of the International Apple Shippers Ass'n, which has been so thoroughly published, and are well known to the farmers as well as the apple dealers.

Results have shown that the largest crop of fool apple buyers did business in 1907, of any year of the decade; men, who for years, have attended conventions, helped frame rules for uniform packing and grading, some of them called upon to read papers at State Horticultural meetings, and then so soon forgetting what grading really means, they went into the field and bought and packed everything the trees produced, except, possibly, the leaves. I believe if the crop of apples of 1907 had been graded and packed properly, at least one-half the fruit which went into barrels would have gone to the evaporator and cider mill.

This may seem a strong statement to make, but I really believe it to be true. I certainly envied the farmer who had a crop of apples, good or bad, to sell during the summer of 1907, as he found it possible to sit on his front porch and sell to a lot of hungry dealers, every apple on his trees at from $3.00 to $3.50 per barrel. Let us hope that a repetition of this will not come often, because if it did, the majority of the old line apple dealers would be financially ruined, and the farmer would not see the necessity of caring for his orchard, and you can't blame him as long as there are a lot of eager buyers, with more money than brains, who are ready and willing to take everything in sight.

Regarding the old ways of packing apples, especially in barrels, I very often think the least said on this subject, the better. It would be ridiculous for me to censure the grower, because in nine cases out of ten, he has very little to do with it, except when packing his own apples, as the buyers, after getting control of the crop, generally pack it to suit themselves, and I am sorry to say, we get back to the same condition; an utter disregard of grades. For years Canada has had a notorious reputation for her dishonest method of packing apples, until the government was compelled to try to remedy the case, and passed laws compelling packers to brand their variety, grade, and their name in large letters on each barrel, and all apples must be inspected by government inspectors, and must be graded up to the mark under penalty of the law. Even this plan did not give those interested absolute relief.

Regarding grades, especially in barrel apples, I believe that there are not two men in Missouri who have the same idea regarding color, size and conditions that are necessary to make a strictly No. 1 apple; consequently, when a difference does arise, it is a very hard matter to settle. Experience has taught me, that market conditions at the time the apples reach their destination has considerable to do with the judging of grades. For instance, if the fruit arrives at destination and the market is strong, and there is a profit in sight for the buyer, the fruit passes muster and the trade sticks; the quality, of course, being satisfactory, and the car paid for in due time; this being a case where the buyer and seller's judgment on grades agree. On the contrary, if the market is weak and no profit in sight, with perhaps a loss, it is remarkable how much difference there is in the quality of the same car of apples, and I have found it very hard, and at times impossible, to convince the prospective buyer, the car graded up to what I had sold him. The above I mention just to show how easy it is to have a difference of opinion regarding grades, packed in the old way of packing.

I have previously stated all I think it is necessary to say regarding the only ways of packing apples. My first deal of any magnitude in the new ways of packing, came at a most inopportune time from a financial standpoint, happening as it did, during the panic of 1907, and values declined very rapidly at that time. In August, 1907, our firm contracted for 50 carloads of western box apples, and before one-fifth of the apples arrived in Chicago, the panic was upon us, and in a very short time it dawned upon me that all box apples were high-priced at about 33⅓ per cent discount of the prices I agreed to pay. The apples continued to arrive, and I continued to pay drafts at contract price, simply because the shippers were giving me what I had bought, and there were no two ways about it. There was not even a shadow of a loop hole out of which a weak-kneed buyer might crawl, and I don't mean to say by this that I was looking for such a loop hole, but just looked around to see if there was one there. The upshot of the whole deal was, that I very gracefully accepted these apples, as they were just what I had purchased in every respect, and in all my past experience, I cannot recall a time when I so strongly hoped the shipper would fall down on his grading. A finer assortment of fruit I had never before seen in one lot. Very remarkable, I think, when out of a lot of 30,000 boxes of apples, you could not find a dozen boxes that one could reasonably complain of, either as to packing or quality. Every apple perfect in color and shape according to mark, not one bruised or deformed in any way, and I did not see one wormy apple in the entire lot. Even though this lot of fruit was bought at strong prices and no profit in sight, I cannot tell you how thoroughly I enjoyed selling them, and admired them each day, as a person does their own production of beautiful flowers and plants; so in our time of adversity, there was some sunshine reflected by the extreme high quality of the fruit we were handling. On the other hand, take those poorly graded, high priced barreled apples, many of them showing a loss to the dealer of from $1.50 to $2.00 per barrel. In addition to this loss, there was the guilty knowledge of a foolish disregard of all reasonable conditions of sensible apple dealing and packing; and a greedy desire on the part of the buyers to palm off on the consumer, a lot of apples scarcely passable for evaporator stock. No matter whether a loss or gain in our business, there is always pleasure in handling fine goods. The association from whom we purchased our box apples, did their part, and did it nobly, and in nowise did we ever blame them for our loss on the apples purchased from them. We bought them with our eyes wide open, and the experience we had that year, to some extent, recompensed us for the small loss sustained.

I feel sure that any dealer can secure, at packing time, 100 cars of box apples from certain sections of the far West, which he can depend upon as to quality, and packing being strictly up to grade, with as much safety as if he had ordered 100 cars of granulated sugar from the sugar trust. Isn't it a revelation in the apple business, to feel that it is possible to buy such quantities of apples, the buyer scarcely needing a representative at shipping point, except to pay for the apples as loaded; this is not absolutely necessary, as we have found it possible to buy $60,000 worth of these apples by depositing $2,000.00 in a local bank at shipping point as a guarantee on our part to accept and pay for the apples if up to grade, and the association makes drafts, B-L attached, for the cars as shipped.

The new method of marketing apples in the northwest is simply this: The growers organize and select their brainiest members for directors, and through the directors, do business for themselves. It is necessary for these directors, who are growers themselves and live in the country, to employ a man to take charge of the details of shipping and accounting for the fruit, and for this purpose they employ a manager. A manager should not undertake to assume the entire responsibility for any of the heavy deals, but will have such questions determined by the directors themselves. This throws the responsibility of the heavy deals on to 9 or 10 men, instead of 1 or 2, and mistakes are less likely to occur. It also assures the business being done according to strictly honorable methods, and precludes the possibility of anyone connected with the management reaping exclusive benefit of inside information. Everything connected with the growers' organization is open and above board, and there are no secrets. It is at times necessary to suppress information regarding prices, etc., for a short period of time, for sound business reasons, but for a short time only.

The organization of growers gives them the same advantage in learning market conditions and fluctuations of prices as enjoyed by any business concern.

Fruit growing districts, whose growers are organized, are meeting with success in their efforts to market their fruit at good prices, partly from the fact that they are properly equipped to get hold of the right kind of information regarding the markets, and partly from the fact that they are endeavoring to improve the quality of their output from year to year. The secret of the success of any growers' organization lies in the fact that they have seen the necessity of doing their own business, and have determined to do it themselves, and do it right. Their work really begins with the planting of the trees, but the growing of fruit is a profession by itself, and one in which many of the growers are very expert. Their success in growing fine fruit helps them to success in marketing their fruit, as they have the right kind of fruit to market.

In order to be absolutely correct in my statements to you, regarding the packing of box apples in the west, I took the liberty of writing Mr. M. O. Tibbits, President of the Wenatchee Valley Fruit Growers' Association, Wenatchee, Wash., and Mr. H. M. Huxley, Manager of the Hood River Apple Growers' Union, Hood River., Ore., for such information as they would like to have made public, and we are indebted to these gentlemen for this information, and in sending us the printed rules and instructions of their associations, they stated that it gave them pleasure to give this information, hoping their experience and results would induce other producers to strive still harder for improved methods. In letters from both Mr. Huxley and Mr. Tibbits, they say that without a shadow of doubt, their individual section grows the finest apple in the world, and it would take a very critical and expert judge to decide which of these two valleys does produce the choicest fruit, and I think these gentlemen have a legitimate right to this claim, and results produced are evidence that their position is well taken.

To give you a good idea as to how they accomplish these fine results in the West, we will have to enter into the following details of the picking and packing, and the printed instructions to growers, which reads as follows: These associations decline to handle your fruit unless you learn how to pick and pack it properly, and cheerfully comply with the rules of the association. The manager will notify you by mail when a variety is to be picked. Upon receipt of such notice, pick, wipe and assort the apples and get everything ready for packers as follows: Packing house, boxes, paper, packing table, nailing machine, nails, etc. Notify the office or the field inspector when you are ready for the packers. The field inspector will then call on you, and if in his judgment, the job is ready for packers, he will arrange to put packers at work. If not, he will advise you how to proceed.

Picking.—If the weather is hot, pick during the cool part of the day. Do not allow pickers to pull off fruit spurs, nor bruise apples by dropping them into buckets or boxes. Apples should be placed in the basket or box and not dropped in or poured in.

The stems of the apples should not be broken off. Haul the apples from the orchard to the packing house daily. Do not allow them to stand in the orchard in the sun.

Wiping and Sorting.—Wipe the apples just enough to make them clean and get off the spray. Do not polish them. Sorting should be done when the apples are being wiped. In sorting, keep the fancy grades and boxes by themselves, and the choice grades by themselves, and the culls separate. Put 4 tier apples and larger together, and 4½ tier and smaller together. Red apples should always be graded for color, 70 per cent or more good red color. Keep the light colored red apples separate from the dark red ones. The grower will be held responsible for quality, and is required to do all the sorting. The packers will not be held responsible in any degree, for the quality of the apples. It is the packers' business to pack apples, and not to sort them. If the apples are not satisfactory for quality upon final inspection at our warehouse, they will be set aside, the grower notified, and a special arrangement effected between the grower and the manager, as to the disposition of the fruit. If it is decided to repack, the repacking will be done at the grower's individual expense. If the apples are to be shipped without repacking, they will be shipped in the next lower grade, or if too poor for the second grade, they will be shipped in the grade to which they properly belong. The grower will be held responsible for quality. The packer is responsible for the packing only. Each grower is required to put his number on each box, with a rubber stamp, in the upper right hand corner of the end. The state law requires the grower to put on his name and postoffice address with a rubber stamp. Each packer, before beginning work, must have his name registered at the office of the union and receive a rubber stamp. He shall be required to stamp each box of packed apples, at the lower left hand corner, with his official stamp. Every packer must put up a first class pack. When a box is packed, the packer shall stamp with a rubber stamp, on the end of the box, in the center, near the top, the exact number of apples the box contains. Packers are required to pack only apples properly wiped and sorted. If, in your opinion, the fruit should seem to be running poor grade for the pack you are putting up, notify the field inspector or the office at once. The packers are all under the supervision of the field inspector, who may dismiss any packer for cause.

Sizes.—3 tier 45. 3½ tier 54 to 96. 4 tier apples include nothing smaller than 128 size, 144 size is special. 4½ tier includes 150 to 175 size. 5 tier includes 185 to 200 size.

Regarding the grading adopted by the two associations, I find that the Hood River Association packs two grades only, the fancy grade and choice grade; while the Wenatchee association packs an extra fancy, a fancy and a choice grade. The grading rules of the Hood River Association are as follows:

Fancy Grade.—This grade consists of perfect apples only. The apples must be free from worm holes, stings, scale, fungus, scab, rust, or any other disease, and free from all insect pests, decay or injury. They must be free from bruises and limb rubs, and the skin around the stem must not be broken. All apples must be clean, fully matured, not deformed, and must have a healthy color. Spitzenbergs must have 70 per cent or more of good red color. All red apples must be a good color.

Choice Grade.—This grade consists of apples a little below fancy, and includes such apples as are not perfect. These must be good apples, not culls. No apples with worm holes or broken skin will be accepted. Limb rubs must not be larger than a ten-cent piece. Only two stings will be allowed, and no sting is permitted, where the skin of the apple is broken. No apples will be accepted if affected with San Jose scale, dry rot, or which show an open or black bruise. Apples showing fungus will not be permitted where the spot is larger than one-half inch in diameter.

The Wenatchee grading rules are as follows:

Extra Fancy.—In this grade all apples shall be sound, smooth, free from worms, worm stings, or diseases of any kind, and of the proper shape, according to the variety. No apples smaller than 4½ tier or 2½ in. in diameter shall be allowed in this grade; nor any apples that are of red variety that are not at least three-fourths red. Delicious, Yellow Newtowns, White Winter Pearmains, Grimes Golden, Belle Flowers, Winter Banana, and Red Cheeked Pippins will be allowed in this grade, but no other variety of yellow apples. Winter Banana and Red Cheeked Pippins must show a red cheek.

Fancy.—In this grade also all apples must be smooth, sound, free from bruises, blemishes, worms, worm stings or diseases of any kind, and of the proper shape, according to variety. No apples smaller than 4½ tier or 2½ inches in diameter shall be allowed in this grade excepting 5 tier apples not less than 2¼ inches in diameter of the proper varieties: Spitzenbergs, Winesap, Jonathan, White Winter Pearmain, Yellow Newtown, Missouri Pippin, Fameuse, Jeffries and Grimes Golden. All apples of red variety, ranging in color from three-fourths red, down to one-third red, will be included in this grade. All varieties of yellow apples will also be included.

Choice.—The choice grade shall be made up of all merchantable apples not included in the extra fancy or fancy grades. These apples must be sound and free from bruises, worm stings, worms, but will include misshapen apples or apples having a limb mark or other like defect. This grade will include apples of all colors and as small as 5 tier or 2¼ inches in diameter, but no smaller. This grade must not be wrapped.

There are only two or three sections of the box apple district where you can at present absolutely depend upon getting as uniform a pack as the case I have just stated, but as the West is strictly up to date in all its fruit methods, we can reasonably look for a rapid advance in packing methods. During the apple packing period of 1908, there have been several hundred cars of western box apples sold at the green fruit auction in Chicago, a few cars each day, and that is where one could learn the quality of the fruit, as well as study the varieties that grow to perfection, or do poorly, in different localities, and one could also get a splendid idea of the packing and grading, and I am sorry to say that many of the cars of nice fruit were ruined by inferior packing and grading, and while I am pleased to tell you something of the excellent work done in the West, I can assure you there are a number of sections where their packing and marketing ideas are very crude indeed, and very radical changes must be made, in order to keep up with progressive fruit marketing.

To give you some idea of how thoroughly the western states are nursing their fruit industry, I read clippings from local papers: "J. H. Holt, Whitman county, Oregon, fruit inspector says: 'We expect every man who owns an orchard to spray it regularly this year, for the law will be rigidly enforced, and those who do not spray will be prosecuted.'"

Also, L. D. Lape, in an open letter to fruit growers in Benton county, Wash., does not mince words in calling their attention to the necessity of spraying. After citing big profits made in fruit growing, if properly conducted, he says: "I want you all to wake up and go after your orchards and care for them in the best possible manner. The horticultural law says that if you do not care for your orchard, the fruit inspector must do it for you, and the law also says that if you do not spray, the inspector will do it for you."

In Umatilla county, Oregon, the court recently decided a case, in regard to two peddlers who had purchased infected fruit and were prohibited from selling it. When the peddlers discovered that they would not be allowed to dispose of the fruit, they brought suit for re-payment of the money. The case was decided by the court ordering the farmer to refund the money to the peddler, and ordered the apples to the cider mill.

I understand the state of Idaho has a law which makes it unlawful to ship a wormy apple out of the state. With this progres--sive spirit, thoroughly instilled into all growers' minds, can we wonder at the rapid progress they are making in their fruit industry, and perhaps we may live to see the day, when fruit packing and grading will be treated in this manner universally, and there will be no room for fruit dealers and fruit growers to have any arguments whatever on quality; the only question to be considered will be the prices.

And now, what has all these fine reports from the far West got to do with old Missouri. Nothing at all, except as an object lesson. For many years, your State has been called the "Land of the Big Red Apple," and I would exceedingly regret to see her lose this grand old name, but it is up to you, Mr. Apple Grower, to fight for your rights, and, in my estimation, the quicker you get at it, the better. Without any doubt in my mind, you still have hundreds of thousands of dollars of equity in your apple orchards, and you must not allow your western neighbors to outclass you, in at least, your efforts, to make your orchards do their very best for their owners. You cannot afford to get discouraged because you do not have as many days of sunshine as they do in the far west, or because you cannot turn on your rainfall any moment you desire, as the farmers in irrigated sections do, but you must do everything else you possibly can, each year, for your orchards. Give it the case you do your horses or anything else you love, and you will be amply repaid in the long run, I am sure. In past years, I know you have had freezes early and late; you have had drouth and apple pests to contend with, and they have these same conditions in other sections, so you are not alone in this respect.

Gentlemen, to my personal knowledge, for 20 years, through the efforts of the members of this association, you have been drummed at constantly, to care for your orchards, and you have been especially blessed by having in your midst a number of public spirited citizens, who, without any benefit to themselves, have year after year devoted their time and knowledge to try and teach you to give more attention to your orchards, and it looks to me as though they have only been partially successful, and their efforts poorly repaid. Many times, in traveling through your State looking for apples, I have been tempted to think that the valuable information, they worked so hard to try and impress upon your minds, has been wasted, and I feel like saying to you that in my estimation, the time is now at hand, for a complete revolution as far as your apple industry is concerned, or you will soon be relegated to the rear as an apple producing community. The results in caring for some orchards of your State, were not entirely without good results even this year. To my personal knowledge, I know instances of Missouri Jonathans selling in Chicago, the past fall, at $7.50 to $8.00 per barrel, and I have sold several cars of only fair Jonathans at $5.00 to $5.50 per barrel, while western box Jonathans have sold from $1.75 to $2.25 per box, equivalent to $5.25 to $6.75 per barrel. You will notice there is very little difference in prices, in addition to which the western box apples had to stand a freight charge of $1.00 per 100 pounds, which is much greater than the freight rate from Missouri. If your orchard is not a large one, and there are a dozen small orchards in your vicinity, form a little association of your neighbors, and buy an up-to-date spraying outfit, and when spraying time comes, help each other, and work early and late until every tree belonging to all members of the association is carefully sprayed. There are a number of other benefits which an association of this kind could accomplish for the welfare of the neighborhood. Should you have a crop of apples in your vicinity, the secretary of your association could do much better marketing it, than each individual could do alone, and when the fruit buyers know of such an association, and know that they can get well sprayed fruit, properly packed in good sized quantities, you may depend upon it that the buyers will seek you out and competition by them for your output, will make it possible for you to get such prices for your apples as the quality would demand. If you select a manager, let him manage. Stick to him through thick and thin, put your back behind him and boost all the time. Make your rules, and see that you personally live up to them.

I am repeatedly asked if apple growing will not soon be overdone in the United States. To the person who has not studied yearly output of apples in this country, and who occasionally reads of the enormous planting of new orchards everywhere, it is very easy to get the impression that the annual output is increasing very rapidly. Taking the figures of the United States Department of Agriculture, on the number of barrels of apples produced each year, I find there has been a very decided decrease since 1896, when there was an output of 69 million barrels, and since that year, a steady decrease until 1900, when there was 47 million barrels produced, and this amount was the general average per year from 1900 until 1904. In 1905, there were 23 million barrels. In 1906, 36 million barrels, and in 1907, 25 million barrels, and I believe I am safe in saying, that in 1908, the output was somewhat less than 25 million barrels. I also believe that the consuming power of the people of the United States as far as apples are concerned, has increased fully 40 per cent since 1896, and with the production of apples having been decreased fully 50 per cent, it appears to me that any person who can produce good apples will find a ready market for them at all times.

Again, referring to the U. S. reports, I find that in figuring the tree census of the U. S. at 100 per cent, that Missouri has nine and nine-tenths per cent or nearly one-tenth of all the trees in the U. S., and that Missouri's average per cent of crop for ten years was 45 per cent, while on September 1st, 1908, your state was credited with 33 per cent of a crop, and if all these trees had been sprayed and cared for as they should have been, what an enormous amount of money would have been turned into your farmer's hands. Taking all of the above as true, does it not seem that Missouri should not allow herself to go backward as an apple producing State? It seems to me that every live apple tree should be put to work to its fullest capacity. At least, I plead with you to try giving them good care for two or three seasons more, and then if you get no results, it is time to think of cutting your trees up for fire wood. If you have abandoned your orchards, and are sure that you will never again try and coax them back to bearing, be square enough with your neighbors who do take care of their trees, to cut out your diseased and insect breeding trees and burn them. If part of the farmers care for their trees, and you are one of those who do not, and you are not broad gauged enough to destroy your uncared for orchards, as you would a diseased hog or cow, a law should be passed to compel you to. In my estimation, a diseased orchard is nearly as much of a public nuisance as hoof rot, or mouth disease, and while possibly not so contagious, I think it is a matter that should be regulated by law. The San Jose Scale alone, is enough to condemn an orchard. It has been proven that it can be controlled, and must be, if you want to turn out apples that will be welcome to all parts of the world. Germany has very strict laws against the San Jose Scale, I know of an instance, where an entire shipload of apples consigned to Germany, which a careful inspection showed was slightly affected with San Jose Scale, was turned back to sea, and not allowed to land. Without doubt, the owners of these apples suffered a severe hardship, but the determination of the German government to protect their farmers from this pest, is certainly commendable, and worthy of the highest praise. Are you aware that two-thirds of the apple orchards of Michigan are nearly worthless on account of this insect; and the scale is attacking trees and shrubs that are not fruit bearing trees, and if the evil is not soon remedied, our fine elms and shade trees will soon be ruined and lost. The trees belonging to the park systems of Chicago, for several years have been more or less affected with scale pests, and the board annually spends thousands of dollars spraying their shrubs and trees. In a conversation with Mr. West, Superintendent of the Lincoln Park System, I learned that he used sulphur wash and found this the most successful for San Jose Scale, scurvy, oyster shell and Putnam Scale. Mr. West stated they would not have to do much spraying this year, inasmuch as the pests had been subdued. So you see that there are still hopes for our apple orchards, and this should not be a time to become discouraged and lose hope, but instead, get to work with a will, and do as thousands have done in the past, reclaim your orchards, not entirely because it will pay you in the long run, but because it is your duty to your neighbor and your State.

Pres. H. N. Gilbert of the Washington State Horticultural Society, in his annual address stated that in his estimation, the present state horticultural law of Washington was crude, and declared in favor of a reasonable law, and his statements as to the kind of legislation he would like to have enacted, were echoed by the leading members of the society. This proposed law is one providing for effective and complete inspection of nursery stock, similar inspection of all the orchards in every county. Rigid and impartial compulsory spraying of all orchards infested with any pests, or disease liable to spread to adjoining orchards. Reasonable inspection of public markets of the State, by intelligent, bonded and responsible inspectors, with the one object of preventing the spread of pests and disease. We have before us, the fruit produced by the State of Washington, and her sister state, Oregon; you have heard the instructions of the association to their growers and packers, and you know of the enormous income, poured each year into the banks of these states for this fruit, and now comes the president of the Washington State Horticultural Society pleading for laws that will still further protect the growing orchards from disease and rot, and tend to improve the already high standard of producing and marketing of their apples, and on the other hand, here you are in old Missouri, slowly going to sleep on this proposition. Does it not seem to you that this matter of State inspection and control of orchard care, should be put under the jurisdiction of your State, and with the enormous acreage of apple trees involved, what better investment could your State make, to restore one of her apparently lost resources than to make a very liberal appropriation of State funds each year, for the carrying of this scheme to a successful finish. We might go further than that. Why not have a joint commission appointed that would have for its territory, the apple producing sections known as the Ben Davis district, covering the states of Illinois, Iowa, Missouri, Arkansas, Kansas and Nebraska, which states, according to the tree census of the United States, contained 31½ per cent of all the growing apple trees in this country. I do not know whether the above scheme is feasible, but offer it merely as a suggestion. The majority of the trees in your State, we all know, are Ben Davis, and while there are coming into existence each year finer varieties of apples than the Ben Davis, we must not forget our first love, even though the Ben Davis does seem relegated to the rear as to quality. I cannot now recall the time when I ever made a very serious loss on good Ben Davis properly packed. I am sure we never again will see the time we experienced one season, a number of years ago, this year in particular being an exclusive Ben Davis year, when a witty Irishman strolled down Water street in Chicago and stated, "That man Ben Davis must have a divil of a big orchard, as I saw his name branded on every barrel of apples in town."

If I intended starting a new orchard I am sure I would not plant many old fashioned Ben Davis, but if I now owned an orchard of Ben Davis trees and they were not doing me much good, I would either get the trees in good working order or cut them down entirely.

The Ben Davis apple does not deserve the unfair treatment it has received in the past few years. Sometimes I am led to believe that many Missouri farmers hate their orchards, because they are composed of the common Ben Davis variety, and if my belief is correct, I consider you penny wise and pound foolish about this matter. Before deciding to express my own opinion regarding the comparative value of York State Baldwins and Missouri Ben Davis, I obtained the opinion on this point of several well posted apple men, and the unanimous decision of these gentlemen was, that should New York, with her Baldwin crop, and Missouri with her Ben Davis crop each have a normal output of good apples, that the Ben Davis would be worth at least 10 per cent more than the Baldwins, figuring from a commercial standpoint. I am sure the crop of 1908 was neglected by buyers, and did not bring the money it should have brought, simply because you have lost your reputation for turning out fine apples, and in order to attract buyers, you must improve your quality. If you will produce fine apples, even though they are only Ben Davis, and let the world know that you have good apples, there will be an abundance of buyers come and see you as was the case in the good years now past.

In conclusion, the best wish I can make for your welfare is, that you will improve your orchards from now on, and find it possible to turn out a few crops of good apples, as you did in years gone by, and may this time not be very far distant.

HORTICULTURAL DEVELOPMENT FOR MISSOURI.

(Prof. J. C. Blair, Chief of Department of Horticulture, University of Illinois.)

Before I ask your attention to some of the things of an experimental nature, of a demonstrative nature, of an educational nature, carried on by us in Illinois, I wish to direct your attention first to the present horticultural situation in Missouri, as viewed from the standpoint of Illinois. I have taken time, not only recently, but years ago, to look into the matter, so as to better familiarize myself with problems which affect the whole Mississippi Valley, because it would be useless for one state to forge ahead and try to make advancement, if another state is not going to do its share in keeping up. The agricultural and horticultural development of the central west must be worked out more or less as a unit.

The horticultural development of any state or any region is dependent on, and determined in part, by the accessibility of the market, the market which will take at a proper value, the different kinds of horticultural commodities or produce which are capable of being produced or developed in that region. This means, then, that the transportation facilities of any region are an important factor, a very important one, in determining the extent of the developed business in that region. Again, we may say that the variety or the particular kinds of horticultural produce, which are possible of being developed in any region, are determined in part by the geographical position of that region, and the influence of its climate and its soil upon the growth of those particular kinds of varieties.

Again, it should be remembered that very often, the largest single factor, having to do with the development of the horticulture of any state or any region, is the *man* factor; that is, the man or the group of men who undertake the development of the horticulture of that section. Indeed, it seems to me that we may say that if the temperature, the soil, the water supply, or any of the other environmental conditions existing in any region, are not suited to the variety or to the particular kinds of plants which it may be desirable to grow in that region, then the right man, or the right group of men, may so modify any of these conditions as to make certain plants do well thereon. Again I say, the right man or the right men, or the right group of men, may so modify the character or the habits of plants or the art of breeding and selection, as to create new strains, well suited to the conditions existing in any particular region. It is evident, therefore, that since any region may be greatly influenced in its horticultural development by the absence, or by the presence, of any one or more of these factors, that that region which has the greatest number of *natural* factors will become a great horticultural region, if we, as a people, or as individuals in this broad field, but do our share in its development.

The key-note, therefore, of my talk this afternoon, is horticultural progress in this State. If I understand it aright, few regions have had a more rapid and interesting horticultural development than Missouri. Nowhere is there a region susceptible of more splendid development, if the people of this grand old State but do their full duty in educating, supporting, and in sustaining this horticultural organization, and also the Department of Horticulture of this magnificent institution. This latter phase of the subject is one to which to devote the most of my attention, and in doing so I must use, as a basis for my remarks, my experience of the past thirteen years in your sister state, Illinois. But before I do this, permit me to refer briefly, to at least a portion of that interesting story which makes up your past horticultural development.

If it is difficult to believe, as we trace the intricate system of tracks that cover the map of Missouri, that only 55 years have elapsed since the first railroad was completed, is it not more difficult to believe, that in practically the same period fruit-growing has developed from a few scattering peach trees, a small strawberry-patch here and there, and a dozen or so acres of apple trees, into its present immense business, ranging as it does, first from the standpoint of actual number of trees planted, or, if you take the statistics you will find that Missouri ranks among the first states in the Union. In 1907, careful estimates were made, showing that more than twenty million apple trees were at that time planted in Missouri.

Now to begin at the beginning: Say in 1800, what was there upon which to base the ultimate advancement in the development of Missouri's horticulture? First of all, there is soil, which has the fertility and the productiveness to be found in all the states of the Mississippi region, rich in prairie loam, sandy soil on hillsides, and heavy gray loam along the rivers. But the climate of Missouri is even a more valuable factor than the soil; its mean winter temperature of 30 degrees, and mean summer temperature of 79, make it a safe home for many of the varieties, or kinds of plants usually accorded only to the southern sections, and those accorded to the northern states as well. Its range of some 285 miles latitudinally and something more than 300 miles longitudinally, gives you practically the same variety of climate found in the east from New York City in New York, to Norfolk in Virginia. This surface of country would include Pennsylvania, New York, Delaware, Maryland, Virginia, greater portion of Illinois, Ohio and Kentucky. To the west, this region is in the same range as in Kansas, Colorado, Utah, Nevada, and a large part of California. It differs chiefly from the latter states in point of altitude, but has the advantage over the eastern states in this very respect—namely, altitude. For example, Missouri has an average elevation of 800 feet as against 625 for Illinois, 700 for Ohio, 750 for Pennsylvania, 375 for Maryland, and is the same as Massachussets and New York. This advantage of altitude possessed by the State, is one not to be overlooked when considering the possible horticultural development of the State. The rainfall, too, as shown by the records which are available, is distributed throughout the year, and is usually ample for the maturing of all horticultural crops. The amount of sunshine also, distributed throughout the growing period of horticultural crops in Missouri is greater than that found in any of the states except some of those in the west.

But the factor, it seems to me, above all, which often has much to do with the development of a horticultural region, is the transportation facilities or the nearness to market. Railroads incidentally follow the rapid increase in population and the corresponding development of the natural industries of the State. Few states in the Union have more miles of railroad than Missouri; in fact, statistics show that the State is not exceeded in railroad mileage to any very great extent, by such states as New York, Minnesota and Ohio. It is held that there is probably not less than 17 miles of railroad in Missouri for each 100 square miles of area. In the matter of population, too, she is no mean rival of at least four or five of our very densely populated states. Add to this the fact that the fourth largest city in the Union is within her borders, and we are able to appreciate the fact that Missouri has a large fruit market right at home; but if she has a surplus of horticultural commodities she has excellent markets, even in the remote parts, in the extreme north and east and south, within two or three days journey of her fruit-producing center.

As I said, Missouri has a population exceeded by not more than four or five other states. In point of fact, the population of this State in 1903, was 3,327,000, and is probably more by this time. I am sorry to say that I have not met all of these people, but I count among my best friends, those whom I do know, and believe that the whole population is a grand lot of people. At any rate, I do know that the Missouri fruit-grower, as I have found him, is an exceptional man in point of intelligence, in point of capacity for constructional work. Again, I do know that the men who make up the horticultural department of this university, and who are in public service elsewhere in the State, stand without rivals. Your chief of horticulture is a man of not only national but international reputation, and I only wish that we had him in Illinois.

Now, if these statements which I have run over briefly are true, are correct (and I believe that the closest examination will show that they are), and also, if my first general propositions are true, then it follows, it seems to me, in the natural order of things, that from the standpoint of natural and material advantages, Missouri stands today without a rival. I want now to say that if your experience in this State is like that of other states, the people of the State must co-operate with the horticultural department of the State university, if the best interests of the horticultural industry are to be conserved, and fostered and developed. I take it that this is the case, always has been, and always will be.

But, you ask me what are the lines that we should consider with respect to the ultimate development looking to the future of this industry in Missouri. I do not know any better way to get at it than to tell you simply my own experience from the standpoint of Illinois. (Professor Blair then read a statement, telling what Illinois has done in the last few years in the way of building up the horticultural work, in all its phases, at the university. Not only pomology has been given attention, but vegetable growing, landscape gardening and floriculture have received careful consideration. He closed with the statement that Illinois, this year was asking the Legislature for $100,000 for horticulture alone at the university, and expected to get it and what Illinois has done and is doing, Missouri with her vast resources can also do. —Secretary.)

ARBOR DAY—ITS SIGNIFICANCE AND OBSERVANCE.

(By Mrs. Virginia F. MacKesson, Lebanon, Mo., Chairman of the Forestry Committee of the Missouri Federation of Women's Clubs.)

Our belief in the practical value of Arbor Day is based upon the idea suggested in the following German proverb, "What you would have appear in the Nation's life, you must introduce into the public schools."

The appalling destruction of our great American forests, and the wasteful methods followed by the tree feller of the past, were due largely to lack of knowledge regarding the economic value of the forest, and its relation to human life. The axe was the symbol of progress. The timber supply was considered inexhaustible, and, without thought of the needs of posterity, the woods-man of former years wielded the axe and saw with relentless hand. Later, came the Nation's inevitable awakening, and, in the general desire to repair the damages caused by the lumberman and pioneer in the past, Arbor Day had its birth.

The facts relating to the origin of Arbor Day are too well known to need more than briefest mention. In 1872, the Nebraska State Board of Agriculture, through the efforts of the Hon. J. Sterling Morton, adopted a resolution, setting apart April 10th as a day for tree planting. As more than a million trees were planted in the then almost treeless state of Nebraska on that occasion, there can be no doubt as to the success of that first Arbor Day. The idea quickly spread until its observance has extended to nearly every state and territory in the Union, and to foreign countries as well. With the passing of years, the character of the day has changed somewhat and it is now associated almost exclusively with the public school. It is no longer devoted entirely to tree planting, its most important feature being the practical lessons regarding tree and forest life and its relation to the welfare of mankind.

Arbor Day is educational in the best and largest sense. It teaches lessons of thrift, economy and benevolence. It brings children, during the most impressionable years of their lives, into closer touch with Nature and opens up to their sometimes unseeing eyes and uncomprehending minds the wonders and beauties of the great out-of-doors.

Arbor Day has its influence on character and morals. It cultivates an appreciation of the things really worth while. It leads the undeveloped child into association with all that is ennobling and uplifting in its influence. In connection with this thought some one has said, "The boy who loves the woods and the fields, can never go entirely wrong."

Important as these benefits may be, the greatest value of Arbor day lies in the tree sentiment created and stimulated by its observance and in the keener appreciation of the economic value of the forest, developed through the practical studies of the day. Forestry is one of the most important economic questions before the world at the present time, and, if present policies are to be carried out, public sentiment must be enlightened and educated. Intelligently observed, Arbor Day may be made one of the most effective agencies through which may be created a sentiment favorable to tree planting and forest preservation. It not only educates the child of to-day, preparing him for more useful citizenship by and by, but through him, Arbor Day lessons are carried into the home, where its further influence is felt.

In arranging programs for Arbor Day, it is well to consider trees from both the economic and the aesthetic point of view. Under the latter head would come the shade and ornamental trees. Selecting those best adapted to the locality, a study should be made of the individual tree and its characteristics, with lessons in tree planting and tree culture, emphasizing the idea, that from a purely aesthetic point of view, the tree has its uses. This may be made more impressive by pictures of perfect tree specimens, of tree-shaded streets and country highways, showing how much properly planted and intelligently cared for trees add to the charm and beauty of our surroundings. That there is urgent need for such lessons is in evidence in every community. Shade trees have been invariably planted too closely together and then hopelessly mutilated by unnecessary pruning. If Arbor Day is intelligently observed, the next generation will make fewer mistakes of this kind.

In considering trees from the economic point of view, it would of course, be impossible to go profoundly into the study of forestry, but Arbor Day offers an opportunity for imparting to children some knowledge of the forest and its uses. The day's study program might include such subjects as: The relation of the forest to human life, the forest's influence on steam flow, climate and soil, its relation to agriculture, commerce and the various industries, as well as a study of Missouri's forests and the value of her forest products.

As sentiment should play some part in the Arbor Day program, the practical lessons may be interspersed with music, quotations on trees and birds, readings of tree and bird poems, tree myths and items about famous trees.

Missouri has no bird day, and as birds and trees are closely related subjects, and bird preservation quite as essential as tree preservation, some part of Arbor Day should be given to the study of our native birds, their economic value and the necessity for their protection.

In localities where trees are not abundant, tree planting should be a feature of Arbor Day. To be worth while, tree planting should be done intelligently and with a definite purpose in view, haphazard planting being of little value. The school grounds should have first consideration, their beauty being much enhanced by well placed trees, shrubs and vines, care being taken that the play grounds be not interferred with. If there is no need for such work on the school grounds, trees might be planted in parks and cemeteries and the grounds around public buildings. Where the ground is available, a grove of catalpas planted by school children, would give opportunity for lessons in practical forestry. An arboretum, planted with native trees and cared for entirely by school children, would have great educational value, in addition to furnishing a pleasure ground for the entire community. But wherever tree planting may be done, it should be remembered that one's duty does not end with the planting; later attention is necessary if the tree is to attain perfect development.

While the observance of Arbor Day alone is recommended, better results may be obtained from the all-year study of forestry, with Arbor Day as the culminating point. To do this, it is not necessary to treat forestry as a separate study, but as an integral part of related subjects, such as are found in all public school courses.

As an aid to the forestry movement, Arbor Day is important. Through its teachings, an interest in tree and plant life is awakened, and a sentiment in favor of tree planting and forest preservation created. Its influence on the child of to-day will give the men and women of tomorrow a better understanding and a greater appreciation of the forest and its uses.

Some one has said that—"The deserts are grim monuments of the races of the past who knew not forestry or, held it in contempt." That being true, beyond doubt, let us urge the observance of Arbor Day, since its influence will, in no small measure, help in arresting the destruction of America's forests and save us from the desolation which followed deforestation in the Old World countries.

RELATION OF EARLY MATURITY TO HARDINESS IN TREES.

(By R. A. Emerson, Professor of Horticulture, University of Nebraska).

That there is a close relation between early maturity and hardiness is well known. Every one knows that a tree might be killed by a light freeze in June, though it had withstood the extreme cold of the preceding winter. I do not want it understood that I consider lack of maturity the only cause of winter injury. Some plants are constitutionally hardier than others of the same degree of maturity. For instance, beans and peas behave very differently toward frost, the one being killed and the other uninjured, though both may be immature and growing rapidly. Then, too, as you well know, the Department of Horticulture, at your own University, has shown that some trees, particularly peaches, are often seriously injured by comparatively light freezes after having been started into activity by untimely warm weather in late winter. It has also been shown that trees which mature their growth early are likely to start growth more readily during warm periods in winter. Hence the condition of maturity which might favor freedom from winter injury in the northern part of your State, and which certainly favors it in Nebraska, is apt to result in injury in the southern part of Missouri. What I shall have to say applies particularly to Nebraska, and perhaps also to northern Missouri. Mr. Chandler will doubtelss explain to you the condition of maturity which is best for your State.

Before calling your attention to some of the ways in which

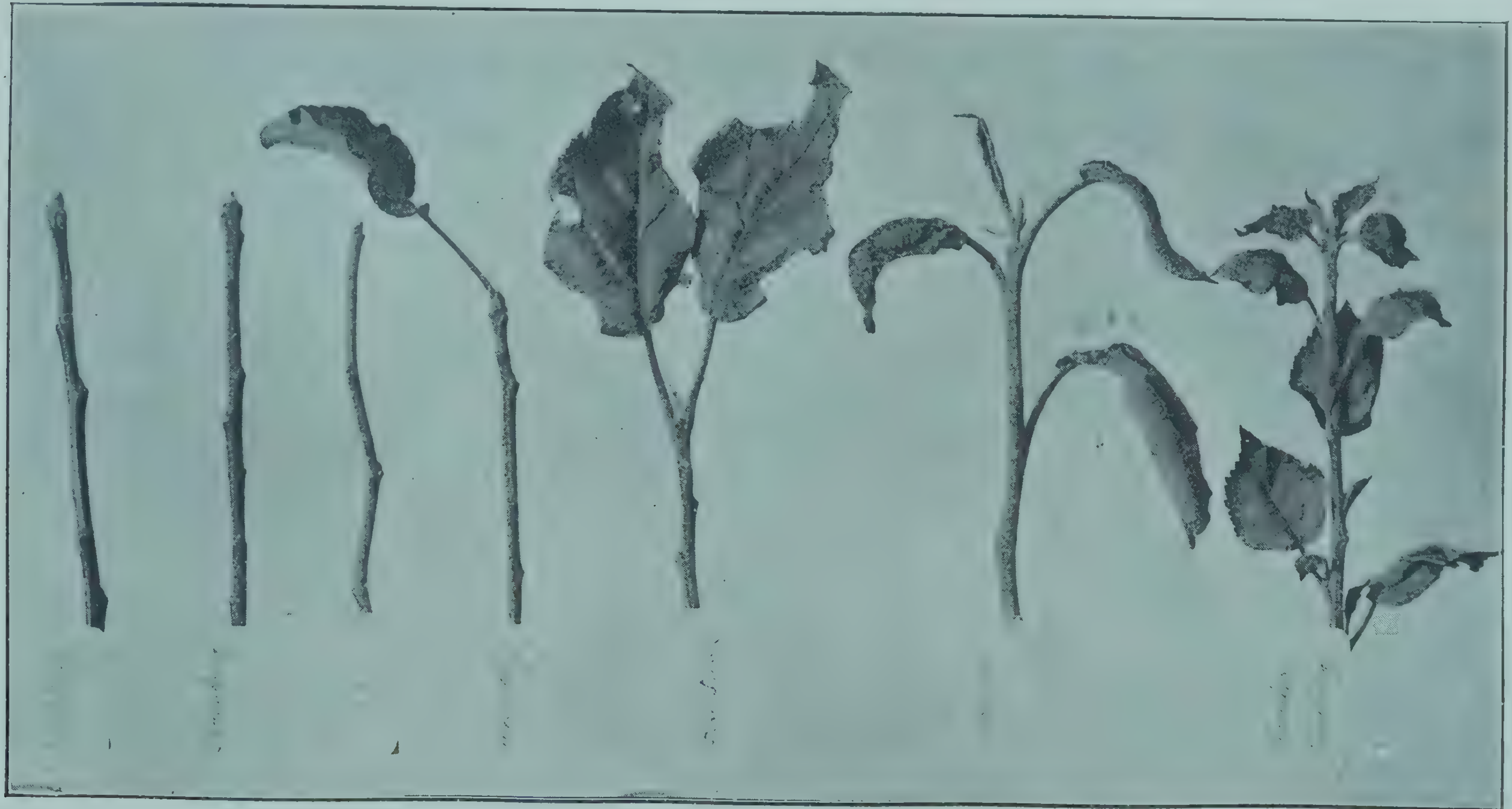


Figure 1. Relative maturity of twigs of different varieties of apple on December 14, 1904.

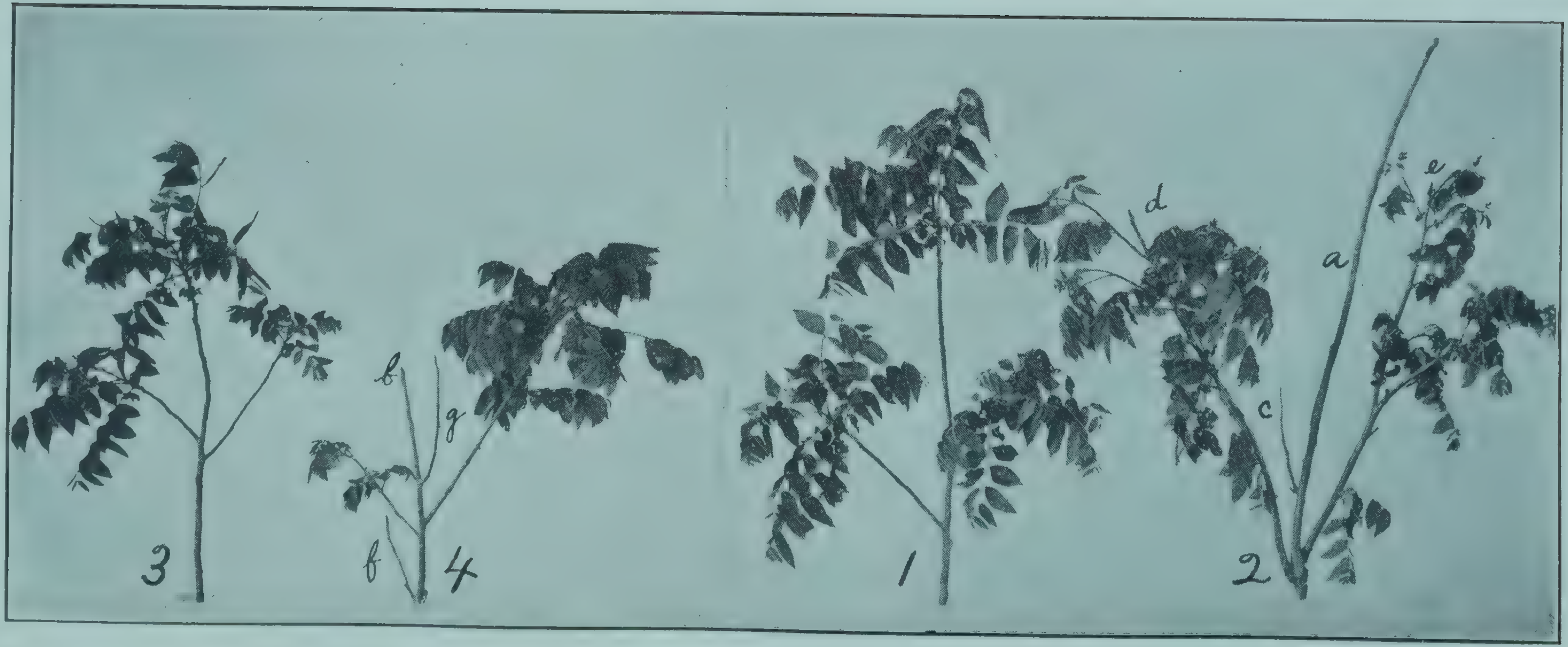


Figure 2. Winter injury to black walnut trees grown from seed obtained in various localities. (1) Seed from South Dakota, (2) Georgia, (3) Nebraska, (4) South Carolina.

a knowledge of the relations of early maturity to hardiness can be made use of by the practical horticulturist, I desire to give you a few illustrations of this relation.

In the group of plants to which plums and peaches belong, some species are hardier than others, and some ripen their wood earlier than others, but is there any connection between these two facts? The peach is an extremely late grower, and is not hardy. The Chickasaw plums mature their wood fairly early and are fairly hardy. The wild plums of the northwest stop growing early and spend the whole autumn in maturing their tissues; and you all know that the native plums are ironclad in hardiness.

The same thing holds true for varieties of apples. The Whitney crab in Nebraska nurseries stops making length growth in July, and all the warm weather or rains of autumn cannot induce it to make a second growth. The Oldenburg stops growing almost as soon, but will sometimes make a small second growth. I need not remind you of the hardiness of the Whitney crab, nor tell you that the Oldenburg is only slightly less hardy. The Wealthy and Northwestern are somewhat slower in maturing their summer's growth and, while hardy, they will, nevertheless, not stand the trying conditions the Whitney or Oldenburg will endure. Ben Davis, Winesap, and many other varieties, mature their wood fairly well, and with us in Nebraska are found hardy, yet they are injured some winters. Grimes Golden is still later in maturing, and one-year old nursery trees of Grimes are often killed to the snow line, even in Southeastern Nebraska.

All of you know that young seedlings or grafts are winter injured much more frequently than older trees of the same sort, providing the trees are not so old as to be feeble. It only remains to note that the young tree grows more vigorously and grows later in the fall than the old one.

In Nebraska, peach trees are rarely planted on low ground, but are put on hillsides or on high land. Our planters have learned from experience that peach trees will not survive our winters on low land, or that if the trees survive, the fruit buds will be killed. Now, it may be a little colder in low places than on high sites, but low land is not usually so much exposed to the cold winds of winter as high land. The real reason why peaches winter-kill in low protected places is that they grow too late in such situations and do not mature their wood properly before winter comes on.

At the Nebraska Experiment Station we have a very interesting collection of Black Walnut trees from seed grown in various localities, from Florida to Canada, and from Vermont to California. The trees from northern seed stop growing long before those from southern seed. The trees from South Dakota seed, one fall, were bare of leaves nearly a month before California and Oklahoma trees shed their leaves. The Nebraska trees were not far behind, but the trees from seed obtained from North Carolina, South Carolina and Georgia shed their leaves in readiness for winter after the Nebraska trees had been ready a month, and the South Dakota trees had been waiting six weeks. But the important thing for us is the fact that the trees from northern seed, the trees that ripen their wood early, have never been injured by any winter since the seed was planted, some nine years ago. The trees from southern seed, on the other hand, the trees that grow late in the fall, have killed back somewhat even in the moderate winters, and in severe winters some of them have been killed nearly to the ground.

Now, how can we make use of this relation between early maturity and hardiness? In the first place, we can select hardy varieties by choosing the one that ripens early. In the case of new varieties received for trial or in testing seedlings, we can tell fairly well from the behavior of the trees during the first and second years in the nursery, whether they will prove hardy or not. Just plant the apple seedlings or grafts of the new apple along with a few Whitney, Oldenburg, Wealthy, Ben Davis and Grimes Golden, note carefully, during summer and fall, the time that the growth stops in case of the new variety as compared with the standard varieties, and you have at once a fair idea of how hardy your new sort is.

We can apply the same tests in a way to forest tree seedlings, but it is not so important with them. In getting seed for forest trees, or, in fact, any tree or shrub that comes true from seed, get seed from trees as near home as possible. If you do this you will be getting seed from trees that have accustomed themselves to the length of your seasons—trees that stop growing at the right time and that therefore are hardy.

I might add in this connection, that the same rules do not hold for fruit trees, or probably any kind of trees or shrubs that can not be propagated by seed. Several years ago, I secured scions of four varieties of apples from some fifteen or sixteen different states, including northern and southern, eastern and western states. The varieties were Oldenburg, Red Astrachan, Ben Davis and Red June, all standard varieties, representing various degrees

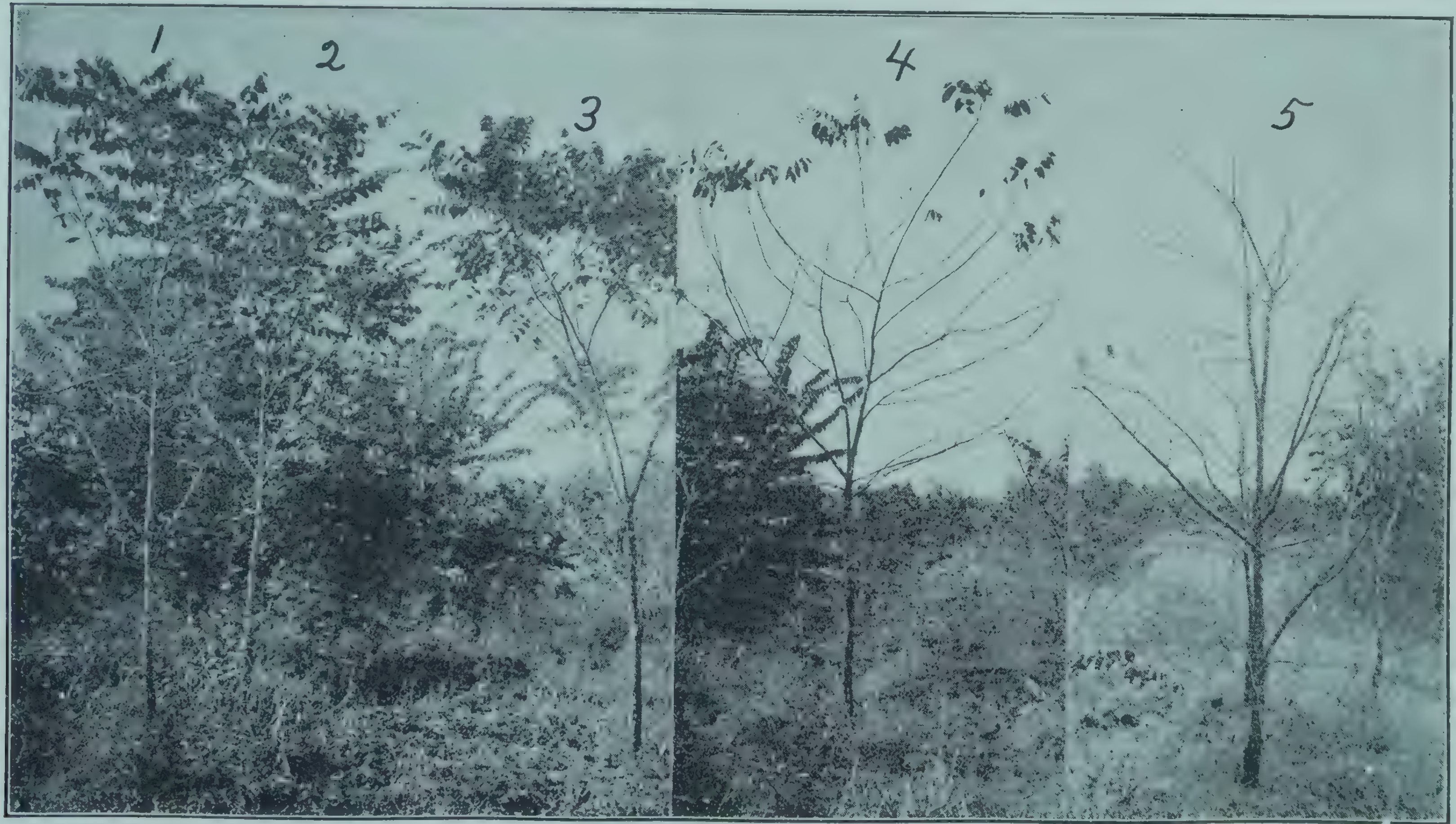


Figure 3. Fall maturity of black walnut trees grown from seed obtained in various localities, as seen September 30, 1903: (1) North Carolina, (2) South Carolina, (3) California, (4) Nebraska, (5) South Dakota.

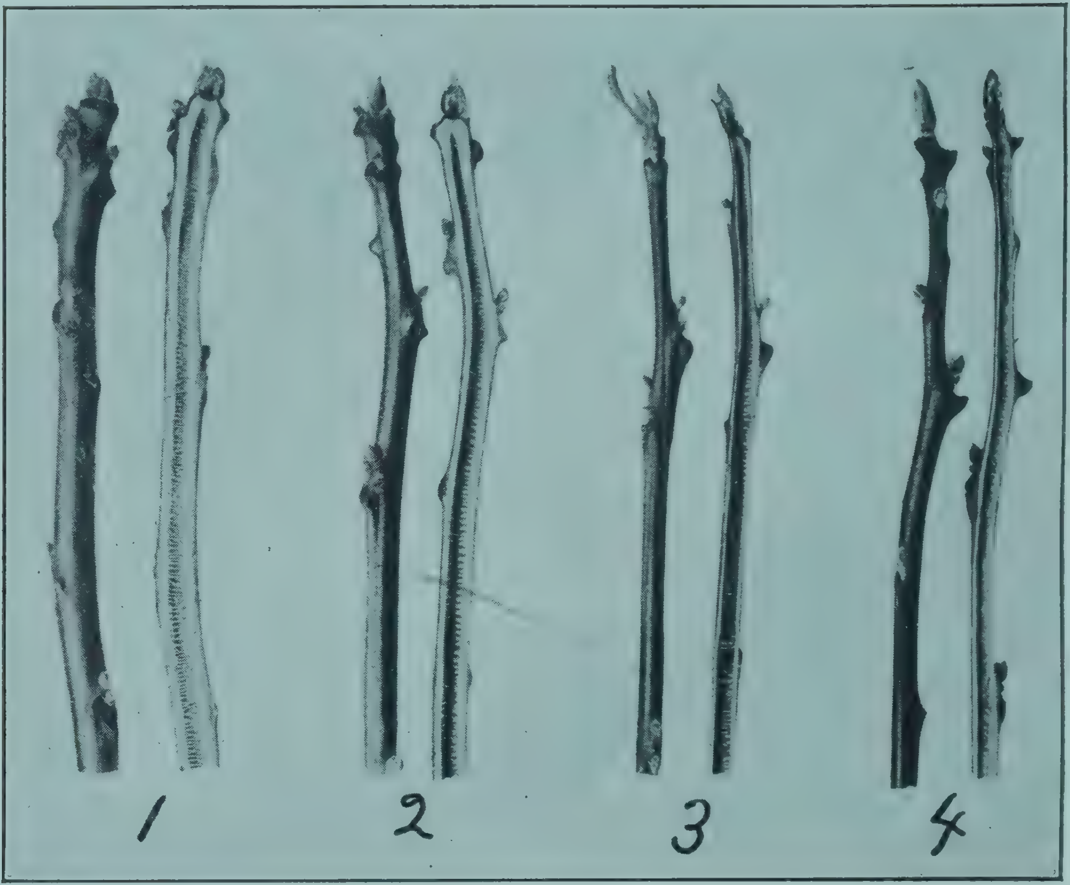


Figure 4. Black walnut twigs, showing difference in maturity on September 19, 1902. The trees were grown from seed obtained in (1) Nebraska, (2) South Dakota, (3) South Carolina, (4) North Carolina.

of hardiness. The scions were taken in each case from old trees or from trees that had been propagated in that particular place for many years. The trees from all different localities were grown side by side in our nursery. There was, of course, a very noticeable difference in time of maturing between the different varieties, but I could find no appreciable difference in the time of ripening between the various lots of any one variety. The Red June from the north ripened as late as the same variety from the south. The Oldenburg from the south had not acquired habits of late growth. Now, this does not mean that fruit trees propagated exclusively by budding or grafting can never adapt themselves to the new conditions of any region into which they may be taken. Perhaps they might do this in time, but the probability of any change in any ordinary length of time is so small that it can be disregarded. It is perhaps possible that a tree growing in a northwestern nursery may be a trifle better able to withstand our dry conditions when first set in the orchard, but once my Oldenburg apple has got to growing, I would not care whether it was propagated east, west, north or south. There are very good reasons for patronizing home nurseries, but the adaptation of home-grown fruit trees to home conditions is not one of them. It is almost wholly a matter of variety.

There are other ways in which we can make use of the relation of early maturity to hardiness. We can often bring about conditions that will favor early maturity. Plant the more tender things on high land where they will stop growing early in the fall. In case of irrigated land, withhold water during late summer. Avoid over-fertilizing the land, especially with nitrogenous manures. Practice systematic pruning, so as not to excite an over vigorous growth at any time by heavy pruning. Stop cultivating and grow a cover crop in the orchard in late summer to dry the ground somewhat and make the trees ripen their wood. The value of this for peaches has been shown beyond dispute at the Nebraska Experiment Station. In regions of very scanty fall rains, the late summer cover crop may be found to leave the ground too dry during winter, but at the Nebraska Station the ground under the cover, has held more moisture during the winter than bare ground. In short, where hardiness is of prime importance, we must be content with a rather slow, well matured growth.

DISCUSSION.

Mr. Darsche—In general, would you say there is more danger in winter killing or in spring killing in Nebraska?

Prof. Emerson—If July and August are dry, we think there are about even chances. However, very often there will be a crop in Eastern Nebraska when there is no crop in the drier portions of the State.

Mr. Dutcher—Would you advise digging trees in the fall and not leaving them out for freezing?

Prof. Emerson—I should not care to answer.

Mr. Dutcher—Have you ever compared fall dug trees with spring dug trees?

Prof. Emerson—No; we have never had any spring dug trees to compare them with. We dig in the fall altogether. We usually prepare beds four feet wide and as long as necessary. The earth is banked up and afterward straw is piled on top. Most of our nurserymen use some system similar to this. We sometimes get 100 per cent to live in this way.

Mr. Darsche—I am under the impression that the farther south we get, we will find more spring dug trees. I should like to hear from Mr. Stark.

Mr. Stark—It is true, that the time of digging varies in different localities. In Huntsville, Ala., we dig in midwinter. In other places farther north we dig in early spring.

MISSOURI'S OPPORTUNITIES IN FORESTRY.

(By Samuel J. Record, Forest Supervisor, Arkansas National Forest.)

It is time every state made inventory of its natural resources with a view to their perpetuation. Our future prosperity depends in large measure upon the care and conservation of our present wealth. Where there is waste, measures are desirable for its prevention; where depletion, there should be plans for replenishing; where exploitation, there should be conservative use.

Missouri is a grand State, of many and varied interests. Her seventy thousand square miles support a population of nearly four million people, whose main sustenance is agriculture. Thirty-five million acres are in farms, and the value of one annual harvest is a quarter billion dollars. She takes first rank in horticulture, and

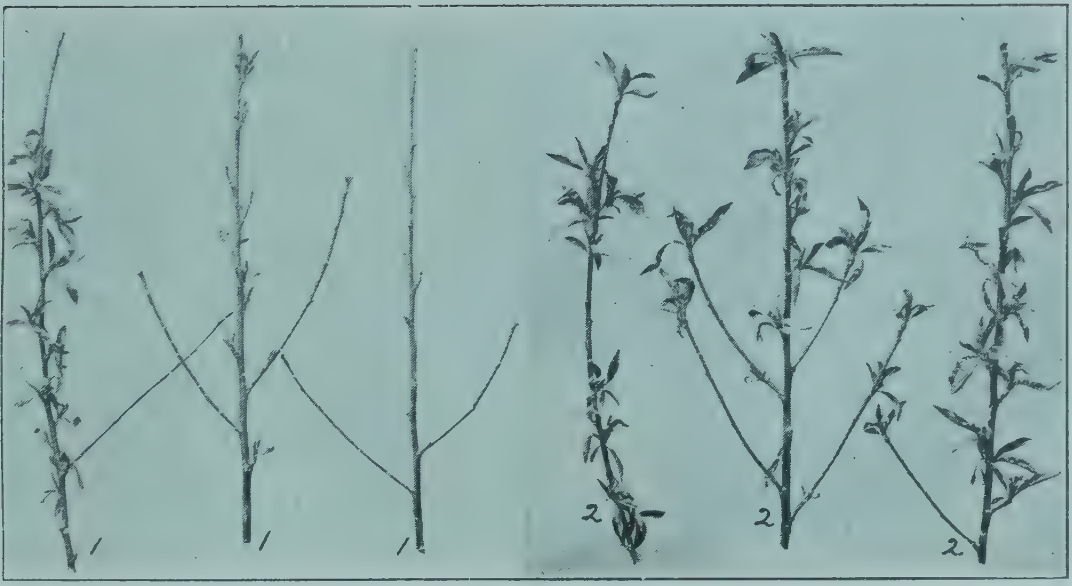


Figure 5. Peach twigs showing (1) severe winter injury where given late fall cultivation, and (2) very slight injury where a cover-crop was grown the fall before.

millions of apple, peach and other fruit trees are yearly adding to her wealth. The natural advantages of favorable climate, fertile soil, and accessible markets, are especially conducive to the raising of live stock. In mining, the State plays a most important part, especially in the production of zinc, nickel, lead and iron. Thorough knowledge of these industries is essential to the proper development of the State whose every foot of soil should be devoted to its most paying production.

Missouri's forest wealth is one of her greatest assets, and if properly handled, will prove a source of perpetual revenue and profit. After making due allowance for all the needs of agriculture, horticulture, stock raising and other industries, there remain millions of acres of soils capable of growing forests but worthless for other purposes. It is then paramount that these absolute forest soils be put to a remunerative use, that they prepare to supply Missouri's future timber demand.

MISSOURI'S RANK IN THE TIMBER INDUSTRY.

About three-fifths of Missouri's area was originally covered with timber. The wooded area in 1900 was estimated to be 41,000 square miles, or about 60 per cent of the State. Recent investigations indicate that about 27,000 square miles or 39 per cent., is at present timbered.

It is to be regretted that there are no reliable estimates as to the total present stand of merchantable timber. My own guess as to the total amount is five billion feet board measure. The amount sawed into lumber can be closely approximated. In 1880, 400 million feet; in 1890, 402 million feet; in 1900, 724 million feet.

Estimating an average cut between census dates, it may be safely estimated that the total lumber production of the State since 1880 has exceeded fourteen billion feet. In 1907, Missouri stood 24th in rank, producing 1.4 per cent of the total lumber cut of the United States, amounting to five hundred and forty million feet, an average yield of 32 feet, board measure, per acre. *Figuring the present stand at five billion feet, continuing the present rate of consumption, the end will be reached in ten years.* Virtually all of the standing pine timber will have been removed in five years. Admitting the general unreliability of such prognostications, at best, it is but a few years until Missouri ceases to be important as a timber producer. On the other hand, her agricultural and other interests will increase manyfold, thus constantly increasing the demand for wood material. The proper use of the absolute forest soils of the State would prove sufficient for necessary future demands for timber.

FOREST REGIONS.

There are two main topographic divisions of Missouri, commonly called the Ozark and the prairie regions. The northern and western parts of the State are mainly smooth, the southern part mainly rough. In a general way, the line separating these two regions follows the Missouri river from its mouth to the vicinity of Miami, Saline county; thence it runs southward to Windsor, Henry county; and thence southwest to where Spring river crosses the State line in Jasper county. South and east of this line the Ozark region, north and west of it the prairie. There may be also included a third division, known as the Mississippi bottoms.

The elevation of the country around the foot of the Ozark region is about 800 feet above sea level. The elevation of the top along the central part of the axis varies from 1,400 to 1,700 feet. The central part of the Ozarks is not extremely rugged, though rather high. Around this central part is a region much more rugged, where the valleys are deeper and narrower and the whole country cut up with innumerable deep ravines, although the general elevations are not so high as in the central region. To the outside of this belt of rough country, is the border of the Ozarks, which is less rugged and slopes down to the prairie and the Mississippi bottoms.

The Ozark region comprises most of the absolute forest land of the State, which should be largely devoted to the growth of timber. Although the heaviest timber is in the Mississippi bottoms, in the extreme southeastern portion of the State, it is only a question of a few years until it is removed and the soil reclaimed for agricultural purposes. The remainder of the State is mostly prairie, with trees occurring only in groves along the streams. Hence, it is the Ozark region which is naturally fitted to be the source of Missouri's future timber supply.

THE MISSISSIPPI BOTTOMS.

In the Mississippi bottoms are dense stands of excellent timber. The cypress, which is one of the oldest and most important trees known, has been largely cut out, and there is small chance of its regeneration. Red gum and tupelo are still in abundance, but

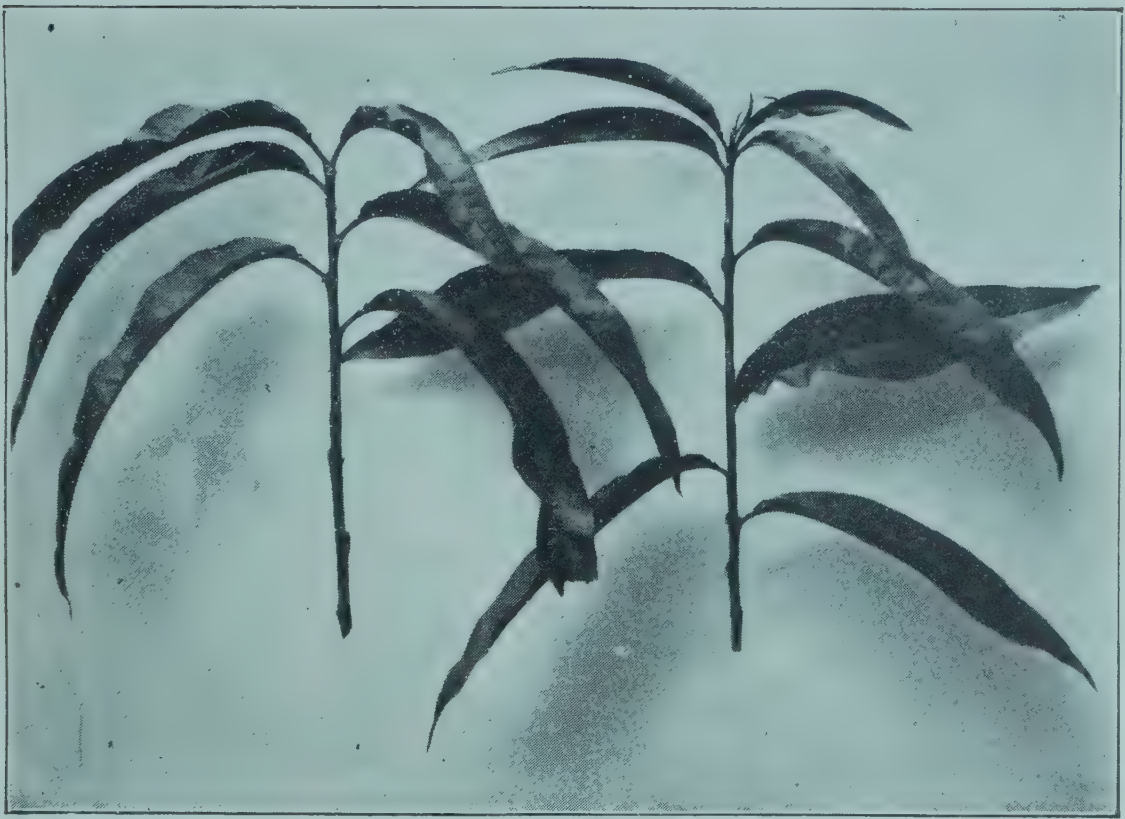


Figure 6. Peach twigs showing the mature condition in early fall of trees with a cover-crop and the natural immature condition of trees given late cultivation.

enormous waste has resulted, because proper methods only recently have been devised for the handling of these timbers. There is also the rapid-growing cottonwood of large dimensions, giant oaks and numerous trees whose rank and importance may not be questioned. The alluvial soil is deep and rich, and if drained, will prove valuable for cotton and other agricultural crops. And yet a large per cent. of this land can be profitably devoted to the growing of timber. The red gum and cottonwood, the willow and catalpa, each on its favorite site, finds conditions suited to most prolific growth. So rapidly do these trees develop that successive cuts of merchantable timber may be obtained at intervals of 20 to 30 years perpetually. An improved method of cutting the timber in strips has been devised, which permits clean cutting of alternate strips and assures natural reproduction. For large companies the plan will prove eminently successful.

THE OZARKS.

In the Ozarks most of the commercial forest has been cut over. At one time shortleaf pine was the important tree in the mountains, but its originally limited distribution has been further reduced until it has almost ceased to be an important factor in the lumber production of the State. The oaks—black, white, red, Texan and others—compose the bulk of the forest, and have contributed extensively to the manufacture of lumber, ties, posts, cooperage, wagon stock and furniture. The black walnut and white oak have long since been removed, one to furnish gun stocks for our soldiers, the other, oars for our navy. What remains today of the Ozark forests, is but a sad reminder of what was or might be.

In parts of Arkansas the shortleaf pine reproduces most abundantly. This is not true, however, of Missouri, where pine is followed by black jack oak, post oak, pale leaf hickory and other scrub species. The fires kill the young pines, but the more hardy oaks sprout up and form a dense thicket, smothering out the valuable species. In time, the pine may reclaim the land, but it will require centuries for nature to do it unaided by man. There are practicable ways of doing this, but time forbids details. Protection from fire, leaving of seed trees, girdling scrub oaks, and artificial replanting, are means which, under wise direction, will make the rugged Ozark hills pay their tribute to man's enterprise.

FIRE PREVENTION.

The prevention of fires may seem to many neither practicable or desirable, and yet forestry can never be a complete success until adequate fire protection is assured. Fires are very common over much of the Ozark region, being usually started by the farmers to improve the grazing. There is absolutely no doubt remaining in my mind, after my experience in the Ozarks, that fires injure and may destroy the large trees, kill seedlings and young trees, and impoverish the soil. Instead of improving the range, they gradually destroy it by robbing the soil and causing a dense growth of hardwood sprouts, which choke out nutritious grasses and herbage.

These fires may be largely controlled. I have found by experience that it is not so much regulations against them, as favorable public sentiment for their suppression, that minimizes the danger. Adequate laws, backed up by systematic enforcement, and accompanied by a campaign of education that will make such law enforcement popular, will solve the problem. Keep down fires and nature herself will restore the forests.

Fire protection is essentially a function of the State. Though the amount of State and Government land is so small, comparatively, that the direct loss from fires falls almost wholly on individuals and lumber companies, yet, owing to the hardwood character of the forest, the direct loss is usually considered trifling. The loss in soil productiveness and the prevention of desirable reproduction are more important to the State than to the private individual who owns the land, but has no thought of a second crop. An active campaign of education should be begun and vigorously prosecuted until public sentiment favorable to forestry and forest protection results.

PRAIRIE REGION.

The vast prairie region of the State, embracing as it does, much of the finest farming land of America, has also ample room for the practice of forestry. The problem there is concerned mostly with woodlots and small tracts, for the farm is rare indeed that contains no portion chiefly valuable for timber growing. If properly managed, the woodlot will supply the farmer with posts, fuel, building material, and some timber for market.

Every farmstead should be provided with protection from winds. For the live-stock grower, shielding the barnyard and feedlots will economize the grain necessary to fatten animals, since less food will be required to maintain the body warmth of the stock in winter. In summer a small part fenced off from the woodlot will afford cool shade to fattening animals, who lose flesh in very hot weather. A belt of forest trees will greatly reduce the danger of late frosts to the first blossoms of an orchard.

The woodlot should occupy the waste land not suitable for farm crops. Steep hillsides, ravines, swamps, sand dunes, creek banks, rocky slopes, and corners cut off by ditches, creeks or railroads, will sustain a good growth of timber and become an important source of revenue. Forest growth on steep slopes and river banks protects them from erosion by heavy rains and freshets. On the farm without waste land the woodlot should be so located as to afford the best protection. Strips at least five rods wide should be maintained along the windward side, usually the north and west, and in addition there should be a shelter belt around the house and farm buildings. Such timber tracts add materially to the attractiveness and sale of the farm.

While this is for the private individual, it remains for the State to assist, direct and encourage his efforts. The details cannot be given here, but the general plan for such assistance would include educative propaganda, experimental and demonstration woodlots and plantations, and expert advice upon request to all who need it.

PRESENT FOREST POLICY.

The forest policy of the State has been wholly destructive. The work of the future should be wholly constructive. One or two large concerns of the State have made some recent attempts to improve their methods with a view to a second crop of timber, but the efforts have been rather spasmodic and aimless. During the year 1906, an investigation of the Ozark region was made under my direction by the Forest Service, U. S. Department of Agriculture, in co-operation with the Missouri Agricultural Experiment Station. Some good data was secured as a basis for future activities, but the funds were too limited to permit of an exhaustive study. I am informed that Governor Folk has appointed a Forestry Commission, consisting of Dr. W. H. Black of Marshall, Dr. Hermann von Schrenk of St. Louis, Mr. David A. Latshaw of Kansas City and Mr. W. E. Barns of St. Louis. I am not familiar with the plans or scope of this commission.

Considerable interest throughout the State has been recently manifested in the forestry movement. Part of this is due to the general awakening over the country to the necessity for conserving our natural resources. Special credit is due the University of Missouri, and to the Missouri Federatioin of Women's clubs. The time is opportune for a definite constructive forest policy.

A PROPOSED POLICY.

Assuming that the advantages and necessity for forest conservation and extension are clearly evident, the important question arises as to the proper means to the end. It is characteristic of the American people to be long suffering until, as it were, the limit of elasticity is reached, when we suddenly undertake to change the work of decades by summary legislation. In such times, there is danger of going to extremes and of following ill-advisers.

My advice to the people of Missouri, on the forestry question, is to begin at once, but proceed slowly. The methods of a century cannot be revolutionized in a day, and it cannot be expected that a people, who for years have been busy destroying the forests, should suddenly concern themselves with forest protection and tree planting. This change must come gradually, but because of the slowness of the movement, there is all the greater reason for immediate action.

My report of 1906, covering my investigations of Missouri's resources, contains this recommendation, which received the approval of the United States Forester: "To devise and direct a permanent policy along the lines suggested, the establishment of a regular course in forestry at the University of Missouri is recommended. The instructor in charge of this department should be a technically trained forester who, besides his regular duties of instruction, should have charge of the forestry work of the State. It should be his duty to assist land owners in establishing plantations, to aid timber owners in the conservative management of their lands, to lecture at Farmers' Institutes, and other public meetings, and to publish and distribute reports concerning State forest problems and their solution. During the summer months he could conduct field work, employing his forestry students as assistants. This same plan is now being successfully carried out in making a soil survey of the State. It is believed that better results can be secured in this way, at first, and at less expense than by the establishment of a salaried forest commission."

The two years which have elapsed since that report, have served to more firmly convince me of the wisdom of that recommendation. Since education in forestry is now most needed to prepare the people of your State for an impending timber famine, where better can the start be made than at your State University? Thousands of students pass its portals to take their places in the progress of the nation. Each will become in some degree a leader in his community and play no small part in the molding and direction of public sentiment. How important it becomes that these men and women, whether farmers or physicians, lawyers or teachers, should carry with them an adequate knowledge of the principles of forestry, to be able in the impending crisis to choose the true from the false, the practicable from the visionary, the sensible from the sentimental.

Let the instructor be chosen because of his ability, and knowledge of his profession, untainted by political patronage. Give him time and means to organize his department, conduct experiments on the college lands, extend his investigations to the entire State, devote a large share of attention to the aid of farmers and timber owners, and in a very few years he will have laid the sure foundations for a practicable and sane forest policy for the State—quietly, systematically and economically.

METHODS, CONDITIONS AND FUTURE PROSPECTS OF THE FRUIT DISTRICTS OF THE WEST COMPARED WITH MISSOURI AND SISTER STATES.

(By T. H. Todd, New Franklin, Mo., Treasurer of Missouri State Board of Horticulture.)

Note—As a part of the campaign for smaller orchards and better methods of management carried on by the Board of Horticulture, Mr. Todd was directed to go to the apple-growing sections of the West and Northwest, to study methods of cultivation, pruning and spraying, as well as the picking, packing and marketing of the fruit.—Secretary.

Before entering upon the details of this discussion, it might be well to consider the matter of the location of some of the typical sites of the West and Northwest. In the first place a single look at the surroundings of the orchards would lead to the conclusion that they have been scientifically located. The orchards occupy the small, fertile valleys for the most part, and these are most always surrounded by snow-capped mountains. Another factor of interest which helps to make the conditions favorable to fruit growing is that every valley has flowing through it an everlasting stream of clear, cool, water which comes from the eternal snows. Prominent among these rivers might be mentioned the Colorado, Snake, Hood and Columbia, all of which wend their way through the valleys, making of each a paradise which seems to have been prepared by our Heavenly Father as a natural home for the maturity of the apple for the benefit of man.

In some of the localities visited, it was found that in preparing the land, great quantities of stones, boulders and the like had been picked up and hauled off in order that the soil might be plowed. In many of these places there was plenty of gravel and many stones as large as a man's fist mixed through the soil, after the larger stones had been removed. (It might be explained that the soils mentioned are glacial drift.—Secretary.)

What is called the "bench" land on the mountain sides, is generally the best for fruit. On these lands were found many high hills where they were using the water from the rivers below to wash the hills down, in order to make places level enough to plant trees on. In one place it was found that they were in this way transporting a hill nearly one-fourth of a mile to fill up some low places. These lands in their rough state are now selling at from $100 to $300 per acre.

As to methods of planting and growing their fruit, it may be said that some of the men have had extensive experience in making tests of methods and varieties. In one block of trees it was found that a party had planted eighty varieties in order to find out which were the best for that soil. It will thus be seen that these people set to work in earnest and lost no time in preparing for the great work before them. They plant their trees very much closer than we do, filling in between with pears, peaches, plums or prunes. They plant as many as 150 to 160 per acre.

They head their trees reasonably high, and while different methods are practiced in different localities, as a general rule they are cut back, in order to make them more stocky, and to cause them to form more fruit buds, and this seemed to be a good practice. It was noticed where their trees were loaded with fruit that the stocky limbs had to be propped; a great many of the latter being required for each tree. In passing, it might be said the writer believes that our Missouri trees would grow the same amount of apples without breaking or being propped, especially on those that are headed low, and where the limbs are long and rest on each other while bearing their load.

Clean cultivation is their practice, and, as a rule, all have adopted this plan. However, in a number of places it was found, and the growers acknowledged the fact, that they would have to change their method, because their apples did not grow large enough. Where clean culture had been practiced continuously, it was found that the Jonathan, Winesap and many others that might be mentioned, were not growing more than half their normal size, while some of the trees bore scarcely any fruit that would do to pack. On the outside rows of the same orchard, where the trees grew in grass or alfalfa, it was found that the fruit was very fine and above the normal size, which proved very clearly that they would have to make changes in their methods of cultivation. A few parties in these sections were, this year, found to be experimenting by growing red clover in the orchard, mowing it down and leaving it on the land. In every one of these experiments the fruit was found to be very fine. In one instance a buyer was along, who bought the fruit which had been treated in the manner mentioned, at a dollar per box, delivered at the station, and everything except the rotten apples were taken.

It was found that they have to contend with many orchard pests, the same as we do; for instance, the green aphis, the wooly aphis, bud louse and the codling moth. At two points orchards were found that would not do to pack at all, on account of the codling moth. Only one locality was found where scab appeared to any extent. On the whole, the fruit was found to be very fine and clear of worms and diseases.

More or less scale was found at every point visited. This dreaded pest, however, did not seem to be doing very much damage. In two or three instances, parties said that their orchards were thoroughly infested last year, but they sprayed once very thoroughly, and this year they had no scale. They use for scale 30 pounds of lime and 30 pounds of sulphur to 100 gallons of water. For codling moth, three pounds of arsenate of lead to 100 gallons of water. For green aphis or bud louse, a liquid made by soaking tobacco is very effective.

They have heavy winds, but not as frequently as we do in Missouri. The windy season begins about the first of October. Only three orchards were found that had been ruined by hail.

There are very few large orchards, the size generally ranging from five to twenty acres. This seems very small and insignificant to some of us one-hundred-acre men in Missouri. But it is safe to say that some of their fifteen to twenty-acre orchards will produce more in ten years than can be grown on ours that are ten to twenty-five times larger. This may seem to be a very strong statement, and will, no doubt, have to be examined. The explanation is this: First, they never set a tree in a spot that is unfavorable to fruit growing; second, every tree on an acre is made to do its work; and, thirdly, they allow no tree to grow that does not bear, and if they find one of this kind they cut the top off and graft with some other variety that is a success.

It can be emphatically stated that they do not grow a crop of apples every year. They claim to grow some every season, but from the banker's standpoint, for some of these business men were interviewed, only three big crops are counted on out of each five years. It may be urged that this is no better than we can do here in Missouri, and such is the truth, but the difference lies in the fact that the growers of Missouri and sister states, have not always been careful enough in the selection of their land. For instance, when we plant an orchard, we decide on how much we want—one hundred, five hundred or a thousand acres—and proceed to set all of the entire area, every rod of it, whether it is adapted to fruit growing or not, when, as a matter of fact, parts of it may be too low, other places have soil that makes wood growth, but no fruit, and on still other places we fail to get a stand from some cause or other, and we are apt to say, "Oh, well, I have five hundred acres, and some of the trees will bear some time." In other words, we have the broad acre idea of apple growing, which is a sort of hit or miss proposition. Also we are apt to console ourselves with the thought that in "off" years we can piece out our incomes by raising corn, wheat, hogs and cattle, and so fruit growing becomes a secondary consideration.

I might say, too, that they have extensive orchards in the West, and the owners were found to be up-to-date horticulturists, and their orchards not lacking for anything. Also, the people were found to be cultured and intelligent, and in every way fitted for the work they are engaged in.

As to the extent of the fruit districts in the West, we might consider them small, and as yet in their infancy, but increasing rapidly, and wonderfully productive. Think of one firm in Chicago handling over 500 cars of their apples this year! And again, you will find their apples on all our most important markets. They are also exporting to some extent. They are doing more advertising, both foreign and domestic, than all the other apple districts in the United States put together. This means that there is brain behind this great enterprise.

We noticed their apples are bringing the top of the market, or more. You ask why? The question will be answered later in this paper. Let us compare for a moment our areas with these districts. Take our grand old State with over 20,000,000 apple trees planted, Illinois a close second, Arkansas well up, and Kansas not far behind. Then think of Washington with 5¼ million trees, Colorado 6 million, Oregon not far behind—in other words, all these points together having less trees planted than our great Commonwealth, Illinois or Arkansas. This will give some idea of their production according to their area. Points were found where the crop was a failure this year. Canyon City was one of these, also Grand Junction, and both are large shipping places. They are missed very much this year in apple production.

A visit was made to a smudged orchard at Grand Junction, Colo., where, through the kindness of Mr. W. S. Chandler, General Inspector of Fruit, the writer was driven out to the Hamilton orchard. One-half of the orchard was saved from a freeze last spring by using 100 pots of burning oil, each pot containing one gallon. Half of the number of pots were fired at a time, each pot burning about four hours. The owner claimed that he could raise the temperature five or six degrees. Unfortunately he had pots enough to save only ten acres, which was one-half of his orchard, and he said he could easily have saved the remaining ten acres for only the price of the pots, which were twenty cents each, had he been able to get crude oil at four cents per gallon when wanted, but failing this he had to use refined oil at ten cents per gallon. This brought the cost up to a total of $200 in addition to the pots.

As a result of smudging he had ten acres of very fine fruit, while the untreated part was a failure, and there were no apples in the orchards around him. The experiment was a pronounced success.

Too much cannot be said of these men out there who are spending their money and time experimenting, also the pioneers who went to these points in early days, who blazed the way to success for other generations to follow.

The work of the organizations was also noticed, and it was found that they operate on slightly different plans at the various points. All are doing a great work in the way of helping and protecting the small growers. Only for these organizations, many of the smaller growers could not exist. At the same time these organizations are not entirely satisfactory—especially with the small grower. The writer would suggest that no one be allowed to benefit from the organization unless he become a stockholder. It takes considerable money to keep up these organizations, to pay officers, and to buy all kinds of material for the members; and to build large packing sheds, and cold storage plants with cooling rooms, and yet they must declare a dividend for these stockholders, aside from 10 per cent commission on all the goods they handle for their members.

The cost of packing, and also freight rates were investigated. Including all expenses, with commission added, it was found that the cost of a box of apples, from the trees to the car, amounted to about fifty cents in some places, but more, and sometimes less, in others. In Washington, it was found that boxes cost only ten cents, while at other points they cost fifteen cents. It was noticed that freight rates on the average to all points north, east and south was about 60 cents per box. The rates in Oregon were higher than in Colorado or Idaho.

At all the various places they employ slightly different methods of packing, and they all grade differently. Their boxes are different sizes. The packing is done by girls, and they are all paid the same price—5 cents per box. Their packing expenses, on the average, are about double what we pay here in Missouri, while the expenses of growing, packing and marketing are very great. Yet, we believe they have a bright future, as their districts continue to develop in fruit growing. Just a word of advice before leaving this paragraph: The writer does not think it advisable for real estate men in their rush and anxiety to do business, to try to advance this fruit land in prices. The day may come when these apples will have to be sold at an average of 50 cents per box at the station. This would mean a collapse of the business. Everybody would want his money out of his investment. This would mean $1.50 per box for these apples on our market to the consumer, after paying freight and a reasonable profit on handling them. I am not a pessimist; this is a reasonable result that we would all expect to happen. To compare this with the middle west we could stand $1.00 per barrel on the track. This would make our apples cost the consumer, taking our freight into consideration, not more than $1.60 to $1.75 per barrel, and pay the handler fair compensation.

It will be of interest to notice what varieties our western horticulturists are planting. In taking up this question, would say these men thoroughly understand the situation. They take into consideration that they have high-priced land to start with, their water for irrigation is quite an item, ranging, as it does, from $30 to $60 per acre; for growing and packing their labor is costly, and their transportation is very high, compared with ours. Having these expenses before them, they readily conclude they cannot afford to grow the cheaper varieties of apples, and for this reason we found them cutting off the tops of Ben Davis, Missouri Pippin and other varieties of the same grade, and top grafting with sorts that will bring more money. At the time of the writer's visit, the varieties above mentioned were selling at North Yakima at 50 cents to 60 cents per box on track, while Winesap, Winter Pearmain, Chicago, Gano, Rome Beauty and Senator, were bringing from 75 cents to $1.30 per box; Jonathan, Stayman Winesap, Arkansas Black and other varieties of the same class were selling at $1.40 to $1.60 per box, and McIntosh Red, King David and Spitzenberg were bringing $1.50 to $2.00 per box. The Delicious was bringing most any price they would name. We heard of sales for the Winter Banana at $4.00 to $5.00 per box, and of a car load of the Delicious selling at $5.00 per box. From quotations from the Chicago and Eastern markets it is seen that Delicious are selling for 25 cents a piece.

Mr. E. C. Leedy, Traveling Passenger and Immigration Agent of the Great Northern, said: "I was passing the Kunze grocery store on Randolph St., in Chicago, a few days ago, and I noticed in the window some of the most magnificent specimens of the Delicious apple I have ever seen. They were from Wenatchee, Washington. I stepped in to learn the price—they were retailing at 25 cents each. They were not only 'delicious' in name and quality, but in price as well." The writer noticed 100 or more plates of Delicious apples sold at the Omaha Apple Show at $1.00 and upwards per plate—five apples to the plate. Mr. G. W. Endicot, of Valley Ridge, Illinois, says: "Of all the new varieties that I have been planting for years, the Delicious is proving far superior to any of them as a bearer and keeper. I have had them in cold storage since the 24th of August—gathered them early to keep the birds from ruining them."

This shows that these people are going to confine themselves to the best varieties in the land, and that they expect to pack their apples in the very best style possible. This is why their apples are bringing fancy and even extravagant prices on our market. My hearers, your question is answered. They have the fruit, the best varieties, put up in a scientific pack and sold to a class of people that have the money to pay for them.

Making a study of their plan of cutting back, and top grafting with the selection of varieties that were paying well in their climate, it was noticed where different varieties were planted, side by side, so as to afford a basis of comparison, that the Roman Beauty is a very fine apple in that country. They stick well to the trees. The Jonathan did not seem to be at home at all at the points visited. The finest were found at Payette, Idaho, where Capt. Shawhan is growing them to perfection. The Lawver is redeeming itself in that country, but the Grimes Golden is not what it is here. I saw the best at Montrose, Colo., and they were very fine. In all the different orchards visited—fifty-eight in number—it was noticed that the Ben Davis, Black Ben, Gano and New Ben Davis, all growing in rows, side by side, were showing a very pronounced distinction. This was a little surprise to me, for it was always doubtful in my mind whether the Black Ben Davis and the Gano were two distinct apples or not. They certainly show in that country they are two distinct varieties.

Regarding the Stayman Winesap, it was found that the trees are very fine and able to hold up the heavy load of apples they bear. They are the largest deep red apples the writer has ever seen growing. The King David is also a very fine tree. They should be called "King" for their appearance.

In Mr. Vanderbilt's orchard, in the Hood River valley, the Winter Banana trees were loaded with their large, red-cheeked, golden fruit, which made a beautiful picture. A Delicious tree was also noticed loaded with fruit. As much can be said for the tree as can be said for the apple.

Now, my friends, in conclusion, let us consider things at home while on the question of varieties. Several years ago the writer decided he had planted enough Ben Davis and other varieties of that family, so for the last four years other varieties have been planted. While there will always be a place for the Ben Davis, and other varieties of that family, in my judgment, we now have enough planted, and it is therefore suggested that we begin to reform in our choice of sorts by selecting only such varieties as are suitable for fruit-stand and table use. Select such varieties as have been tested and tried in order to supply the demand of the trade. We find the people begging for good eating apples. They do not inquire about the prices like they do the eating quality. Several of the highest officials of the State have said to me that they hoped the horticulturists would raise the standard of varieties, so that they would be a credit to the State. These men claim they do not care so much for the prices they have to pay for apples—what they want is satisfaction, and it follows that when people of this class purchase fruit, and are pleased with its eating qualities, they feel their money has been well spent, and will buy more.

My friends, let us not be jealous of Western growers. They have spent their money and worked hard to get themselves established. Let us give them credit and praise for what they are doing—they deserve it. They have advantages and disadvantages, but they all work harmoniously together for success. Let us now at the beginning of a new year, adopt new ideals in our business, and decide to grow better fruit, and raise the standard for better grading and packing.

Regarding the prospects for our future success—we have an equal chance with all other fruit regions, if we will only avail ourselves of our opportunities. If we expect to secure help from the State, we must remove from our minds all selfish motives, envy and strife, and comply with the laws of our great State. Let us come together and work like business men should, putting horticulture on a higher plane than ever before, in order that we may be a credit to our State. Our fruit land is very much below the average price of fruit land in other states, even though we include the famous hill land, on both sides of the Missouri river, clear through the State, and also along the Mississippi river. As to the production and quality of fruit, the Ozark country throughout the Southwest is as good, or even better, than other fruit countries.

Then as our State is located in the central part of the Middle West, tributary to our best markets, freight is very much below the average of other regions and our lands will produce as many crops in ten years as any other country, if we, as fruit growers, will perform our part faithfully and intelligently.

One other thought before closing. No one seems to be scheduled to say anything on the package question. This is an important matter, for the time has come when the Middle Western people, in order to keep up with the demands of the trade, must use smaller packages. In my possession are letters from New York, Pittsburg, Philadelphia and Dallas, Texas, stating that packages are being used as small as one dozen in a box, and selling at the price of $1.00, $1.25 to $1.50 per package. These apples were packed in different states, and, of course, were fancy varieties, such as the Arkansas Black, Spitzenberg, Jonathan and Winter Banana, also Delicious. This leads us to believe the smaller the package the better.

DISCUSSION.

Mr. Glassmire—I should like to know at what age these Ben Davis trees, which Mr. Todd speaks of, are cut cack.

Mr. Todd—Some of the trees—most of them—were nine or ten years old.

Mr. Glassmire—Do they follow the common method of dehorning the trees by cutting off the entire top?

Mr. Todd—Sometimes they cut off all the top and sometimes they left part of it.

Mr. Darsche—How much do they cut off at one time?

Mr. Todd—They cut back the whole top at one time. It is surprising to see the growth that one of these trees will make after being cut back.

Mr. Kingsbury—At what season of the year is this cutting back done?

Mr. Todd—For the most part in the spring.

Mr. Glassmire—You spoke of smudging. Do they have pots for this work? How long does it take to set and fill them?

Mr. Todd—Yes, they use pots and oil, but the time required for setting and filling the pots would depend upon the man doing the work.

Mr. Glassmire—Do you think it would be practicable for the Missouri orchardist?

Mr. Todd—I don't know.

Mr. Kingsbury—At what temperature would you smudge?

Mr. Todd—You should prepare for it when the thermometer drops to around 35 degrees. If you are using pots, you should have them already set and the oil on hand so that you would only have to touch them off. The pots are only used for spring frosts and not for winter freezes.

Mr. Culp—You spoke of spraying. In spraying for the San Jose scale, how often do they intend to do the work?

Mr. Todd—One time is all that they intend to go over the orchard. They use for the scale, 30 pounds of lime and 30 pounds of sulphur to 100 gallons of water. If orchards are badly infected, they use it more than once. It got away with the scale. To us it seems a pretty strong spray.

Mr. Culp—You spoke of the expenses of packing the Western apples. There is also the matter of freight rates. The expenses of shipping a box of apples from Wenatchee to Chicago is about 60 cents per box. After you add the cost of picking and packing, I do not believe that the growers in this section have anything to fear from our friends in the West. We can put apples on the Chicago and St. Louis market, at about the same price per barrel, as they can per box. The only time they can get our trade is in off years. You said that you had been convinced of the fact that the Black Ben and Gano are different varieties, did you not?

Mr. Todd—Yes, this summer. They are very distinct in their differences in that country. There is a pronounced distinction in the color.

Mr. Darsche—Do they differ in color,

Mr. Todd—They differ especially in color. The Black Ben is not so black but has a black cheek.

Mr. Darsche—Is it a different red?

Mr. Todd—Yes.

Mr. Culp—Is there any difference in the shape of the apples?

Mr. Todd—Yes, I should say there is a difference in shape.

Mr. Cox—I should like to ask about the use of oils for spraying.

Mr. Stark—I shall call on Mr. Taylor to answer that.

Mr. Taylor—The miscible oils, or soluble oils, have been used considerably in most parts of this State, probably more in St. Louis county than anywhere else. In experimental work we have used a number of different ones and find them quite as effective as the lime-sulphur compound. The lime-sulphur spray, if too strong, might injure the tree. The use of the oils are borne out in practically the same results in Colorado.

Mr. Todd spoke of smudging in Colorado. I have just received a letter from that state saying that they will use 200,000 of those cans for smudging purposes. It will be readily concluded that they will have 4,000 acres smudged.

Mr. Todd—I believe that this smudging should be tried in a small way, as an experiment. You could easily pick up some old tin cans for a small plot. Crude oil should be gotten at a low cost. The Colorado people get oil for 4½ cents. Their pots will cost 20 cents apiece. Then next spring when the thermometer begins to drop around 35 or lower see if you can save a small patch of fruit.

Mr. Kingsbury—Is there any difference on which side of the tree the pots are put?

Mr. Todd—That depends on the way the wind is blowing. The smoke should be carried through the orchard. I was told that the smudge worked better on nights when the air was stirring slightly than when it was sultry. On sultry nights the smoke was carried straight upward and the heat was lost on the trees. Usually the pots are put down diagonally and close together every other row. The usual rule was 100 pots to the acre. If it is colder you might have to put them closer. It is to raise the temperature that they are put out and you have got to use something to create heat. If it is a cold night the pots would have to come closer together. It is heat you want. I have tried bricks, but have not had much success. We have got to have something that is not too hard to use, and that will be effective when we use it.

Mr. Glassmire—Then you would recommend smudging.

Mr. Todd—For spring frosts the experiment in Colorado was undoubtedly a success.

WHY WE PRUNE.

(By Dr. J. C. Whitten, Professor of Horticulture, University of Missouri, and Horticulturist to the Experiment Station.)

In the management of fruit trees, perhaps no other fact is of greater interest or more significant than that each section of country has a shape, or ideal of its own to which each kind of tree is made to conform. We are struck by the differences between the low growing fruit trees of the Central West, and the lofty ones of the Atlantic coast; we contrast the dense heads, or branching system of the west, and the more open, or spreading heads of the east. Still more striking are the espaliered trees of Europe, whose limbs are often trained like the ribs of a fan, in a flattened form, upon a trellis or against the sunny side of a wall.

Each of these different systems of pruning or shaping is a means of

ADAPTING THE TREE TO ITS ENVIRONMENT.

In the foggy climate of Western Europe, it is desirable to admit all possible sunlight to the parts of the tree. The thin open head exposes the fruit buds, flowers and ripening fruits to the favorable influence of the sun, thereby furthering, what is secured in part, by planting the tree on a south slope, or on the sunny side of a wall.

In the dry, sunny continental climate of the central west of our country, a system of pruning quite opposed to that of Western

Europe, is employed. Throughout the prairie section especially, one is struck by the low, dense heads of the fruit trees. The trunks of the trees are usually from one foot to three feet high, thus securing low heads or branching systems. These low heads help to insure the trees against injury from prairie winds. They lessen the number of windfalls among the fruit. They shade the ground under the trees, preventing undue loss of moisture from the soil. Their shade keeps the soil from becoming too hot during the intense sunlight in summer, and opposes sunscald, which sometimes injures the exposed trunks and main limbs of high-headed, open branched trees. Low heads also, in some degree, retard the blossoming period, rendering the flowers less liable to injury from spring frosts, which here so frequently follow the first warm, sunny days of early spring. The denser branching system aids in accomplishing the same purposes which are sought through the adoption of the low head.

In the various sections of the world where fruit growing is carried on, some intermediate form between the two above extremes is adopted, to adapt the height and density of the head of the tree to climatic influences. In our Atlantic coast states, where there is brighter sunlight, more wind and less moisture than in Western Europe, and yet less sunlight, less wind and more moisture than in the continental climate of the west, a middle ground is adopted with respect to height and density of the head of the tree.

In extreme continental climates the low, dense head is in keeping with the selection of a north or east slope for the orchard. This is an interesting contrast to the south slopes, or sunny location preferred in Western Europe.

FUNGUS DISEASES AND PRUNING.

In recent years attention is being given to shaping the tree so as to oppose fungous diseases. Leaf rust, fruit scab, many of the rots, and many other maladies which affect fruit trees, are now known to be due to parasitic fungi that attack the parts of the tree or its fruits. Many of these parasites thrive better in cool, damp, shady places than they do in sunlight, just as molds develop in cellars or damp places. In a foggy, humid climate, the high, open head admits sunlight and air and opposes the development of these diseases. In a dry, sunny or windy location it may not be necessary to maintain an open head to secure enough sunlight and aeration.

REPRODUCTIVE ACTIVITY AND VEGETATIVE ACTIVITY.

In connection with pruning, it should be borne in mind that other factors than merely shaping the tree, to adapt it to climatic conditions, must be taken into consideration. Fruit trees may be said to expend their energies in two ways: by producing fruit and by producing wood growth. It is a well-known fact that a fruit tree may sometimes grow with exceeding luxuriance and fail to produce fruit. In fact, too much wood growth and leaf growth is opposed to fruitfulness. The orchardist often says of a vigorous tree that it is "running to wood growth" instead of to fruit. Anything which tends to check this excessive vegetative activity usually throws the tree into bearing, or favors reproductive activity. On the other hand, the production of a heavy crop of fruit opposes excessive wood growth.

A proper balance between vegetative and reproductive activity (or wood growth and fruit production) may, in part, be maintained by proper pruning. If a tree is pruned by cutting back or by renewing some of its branches in winter, its wood growth will be accelerated during the following growing season. If a part of the buds, which normally would have been pushed into growth in spring are removed, there will be correspondingly greater growth from the fewer buds which remain. If this length growth is excessive, and if it continues too late in the season, few or no fruit buds may be formed for the next year's crop. As a rule, length growth of limbs is continued at the expense of diameter growth, and storage of plant food in the twigs and buds. Fruit buds usually begin to form in early summer for the coming spring; about the time rapid length growth ceases. The maxim "prune in winter for wood, but in summer for fruit," is an old one.

Cutting out or shortening limbs in summer, when the leaves are elaborating plant food, usually checks wood growth and thereby often favors the formation of fruit buds. Whether to prune more in winter or in summer depends much upon the vigor of the tree. If vegetative activity is weak and the energies of the tree too low for the maturity of a good fruit crop, winter pruning tends to increase its growing energy. If the tree is making too luxuriant wood growth, summer pruning (checking the growth) may result in the formation of fruit buds.

DIFFERENT SPECIES OF TREES REQUIRING DIFFERENT KINDS OF PRUNING.

It should be borne in mind that different kinds of fruit trees endure different degrees of pruning, and that they respond somewhat differently to the treatment.

The cherry requires very little pruning. Its most active buds are the extremities of its twigs. If it is severely cut back the inactive buds that remain may not start readily into growth. The tree may even weaken and die forever from severe pruning. The cherry requires the least pruning of any of our orchard fruits.

On the other hand, the peach profits by severe pruning. It should be severely cut back in winter. It readily puts out new growth, even from the bases of the old limbs after cutting back. It has no "dormant" buds which may not be called into activity if occasion demands.

If a peach tree is cut back in winter so as to produce rank wood growth, it will still produce fruit buds along this new growth. If an apple tree were pruned back so as to secure equally luxuriant growth, this new growth would possess no fruit buds of its own, and by seizing the sap of the tree these new whips would divert growth from the fruit buds below, and would also overshadow the latter by producing too much shade above.

THE RELATION OF THE DORMANT PERIOD TO HARDINESS AND PRUNING.

In recent years an investigation of the dormant period of trees, and of problems relating to their hardiness, is throwing much light upon the subject of pruning. This applies with particular force to the pruning of the peach.

For better understanding, let us adopt a somewhat technical conception of what is meant by the dormant period. Ordinarily we speak of the dormant period of a tree as being that period between the shedding of its leaves in autumn and its starting into new growth in spring.

Investigation has recently shown that during the first half of this winter rest, our fruit trees are in a deep sleep from which they cannot easily be awakened, but during the last half of it they (particularly the peach) may be easily forced into growth providing warmth and moisture are supplied.

One may easily test this point. If a peach tree is taken from the open and planted in a green house during the first half of winter it will lie dormant until about midwinter. If it is brought to the greenhouse in midwinter or later it will promptly begin to grow. The same thing may be shown by bringing in peach twigs and putting them in vases of water in a warm room. During the first half of winter they remain dormant but they are ready to begin growth at once any time after midwinter.

Much of the winter killing of peach buds is due to the fact that they start into slight growth on warm sunny days during late winter, and this growth renders them too tender to endure subsequent cold. Much of this injury may be avoided by inducing their true dormant period, (that deep sleep from which they are not easily awakened), to continue until later in the winter. The earlier a peach tree sheds its leaves or stops growth, the earlier its dormant period begins and the earlier may the buds become ready to grow if warm sunny winter days prevail. The later growth is kept up in autumn, the later will the trees shed their leaves, and the longer will their dormant period continue.

If peach trees in this climate are cut back severely enough in winter, so they grow late the following summer and shed their leaves after cold weather comes on, their buds are not likely to awaken into growth until danger of winter killing is past. This may not apply in colder climates than ours, in which tender late growth may be killed by excessively low temperatures, even though they are fully dormant.

Finally, the man who prunes should understand the habit of each kind of tree with which he works. He should be able to tell the age of the tree by the character of the limbs. It is desirable to be able to observe how much length growth has occurred during each year of the tree's history. The difference between fruit buds and wood buds should be distinguished. The pruner should be able to tell from the fruit scars and blossom scars on what years the trees have blossomed, when fruit set, and whether the fruit properly matured, as indicated by the character of the fruit scar. By comparing these evidences of fruitful and non- fruitful years with the amount of growth made each year and with the kind and degree of pruning which was done in any season, he may reason out for himself the proper pruning to pursue, in order to secure a given result. In other words, the best book on pruning is to learn to read the life history of the tree, during all its past, by the characters which are plainly written on its twigs and limbs.

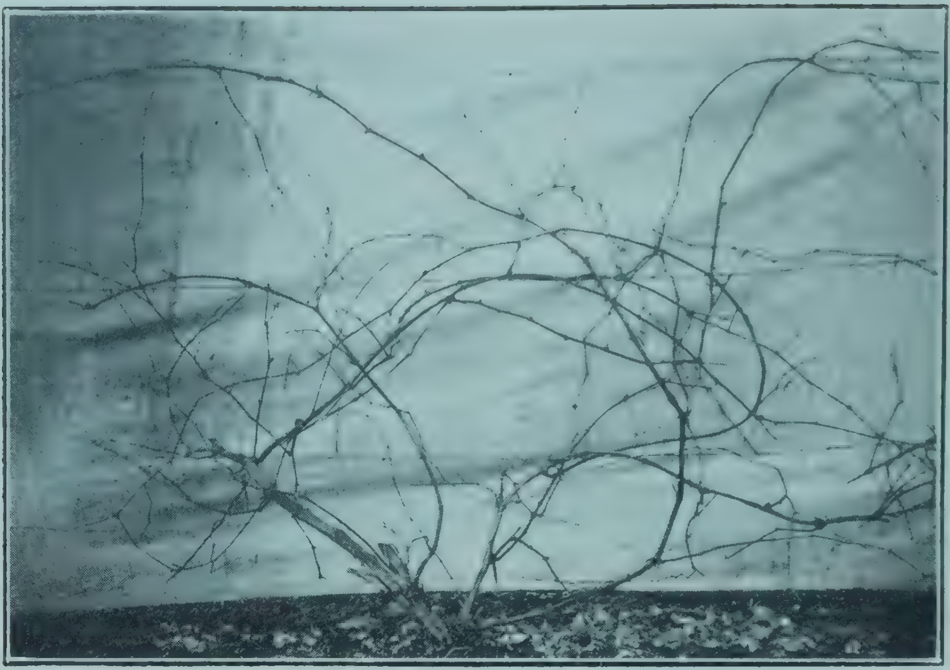


Figure 1. An average year's growth of wood on a grapevine which has been pruned by the renewal system, which aims, as nearly as possible, to renew the vine from the ground each year.

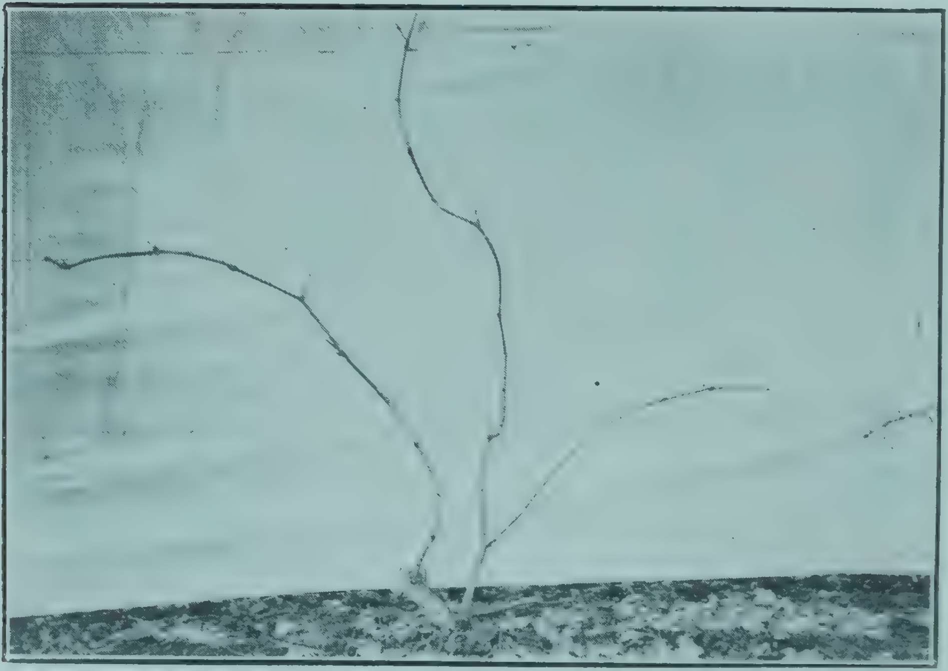


Figure 2. Vine shown in Figure 1 pruned by the renewal system, leaving three fruiting canes of new wood only, which are trained to the wires. In addition, two or three spurs (new canes cut back to one joint) are left near the ground for the purpose of producing new wood growth for fruiting purposes for the coming year.

HOW TO GROW AND CARE FOR GRAPES.

(By E. A. Riehl, Alton, Ill.)

Grape growing dates back to earliest history, but that old story we need not repeat here; nor even the early history of grape culture in this country. Such history is for the student, and, perhaps, for the large vineyardist, who wants to know all about his specialty. I take it that I am expected to give the best and latest methods now known, to encourage the planting of grapes by the common people. He who expects to go into the grape growing business must study the subject more fully than I can do in a paper of this kind. Understand, therefore, that what I shall say on this subject is with a view to encourage the common people to plant more grapes.

High, well drained soil is best, but the grape will grow on most any kind of soil and exposure. Let no one, therefore, be deterred from planting grapes, if he has not the kind of soil that is considered best, but plant on such as he has, and be assured that he can have all the grapes his family can use.

Plant in the fall or early spring, using only one-year-old plants. They are better and cheaper than the two-year olds. Let the rows be eight feet apart, and the vines set about the same distance in the rows. Some strong growing sorts can use more room, while some others may do with less; however, for most varieties, eight feet is about right. Shorten the roots, so they are not more than eight inches long. Plant as deep as they were in nursery row, or a little deeper. The first season let them grow at will; don't prune or pinch in any manner. The main thing the first season is to get the vine well established and make as much growth as possible. Any growth removed by summer pruning is an injury, and tends to retard growth.

In the fall cut away all growth, leaving only a few buds near the ground to make new canes for fruiting. Keep these well tied up as they grow. In the fall of the second year prune, leaving one or two canes, not much over half an inch in diameter, or less, for fruiting canes. Be sure to remove at least half the previous year's growth. Grapes are apt to overbear, and it is never safe to let them set all the fruit they will. If allowed to set too much fruit, they may not be able to ripen it, and will be sure to be late. If allowed to overbear, they may be so weakened as not to be able to bear a crop the following season, and may not fully recover for several years. Five to twenty pounds per vine is a good crop. Most varieties, when well grown, will weigh a half pound to the bunch, and as most varieties set at least two bunches on a shoot, it will be seen that it does not take very many feet of canes to give all the fruit that a vine should be permitted to bear.

There used to be a great deal said about summer pruning or pinching, but I have given that up, and think all the best large growers have done the same. Where the growth is so rampant that there is danger of obstructing passage between the rows, I go along and pinch the ends.

In the fall of the third year, if properly cultivated, the vines should be large enough to bear full crops.

Pruning and training will depend somewhat on surroundings and the owner's fancy. I prefer a trellis of two No. 12 wires, stretched on posts fifteen to twenty feet apart, the wires being three and one-half to five and one-half feet from the ground. Stakes can be used, and two, one on a side of the vine, is better than one. When tying the vines to the stakes it is best to wind the string around the stake three or four times and tie at the top and about the center. When trained on trellis, I prefer to start the young bearing cane from the old wood at about the lower wire. Most of the varieties grown give best results from canes of the previous year's growth, but there are varieties that do better when fruited on laterals from the old wood. Norton, Cynthiana, Eclipse and many of Munson's seedlings, are among the number that are best trained that way.

To prevent rot, the vines should be sprayed with a strong Bordeaux mixture, using about six pounds of copper sulphate to fifty gallons of water. Grapes will stand a solution this strong, and it seems to be necessary for good results that the mixture should contain that amount of the sulphate. Where there are only a few vines, or where a spraying outfit cannot be used, the object sought can be accomplished by inclosing the young bunches in one or two-pound bags, such as grocers use. Slip these bags about the young bunches after they are out of bloom, and before the grapes reach the size of peas, secure with a pin, or, better, with short pieces of annealed No. 22 wire, which is wrapped around the top of the sack and twisted by a half turn, which will hold it securely. This not only prevents rot, but it is a protection against birds and insects. It is very important that this be done before the spores of the rot fungi find lodgment on the young fruit. If the spores are on the fruit when the sacks are put on, or if they have entered the

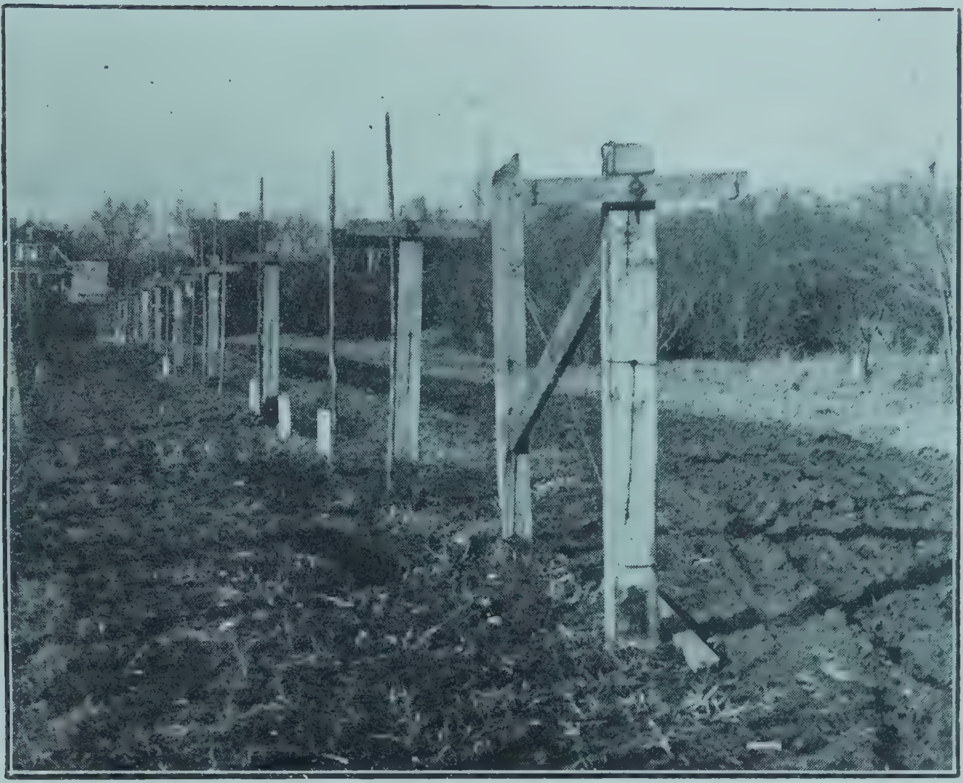


Figure 3. Trellis for training grapevines according to the Munson system. No wires are used except on the cross bars. By this system the body of the vine will have to be about 5 feet long in order to reach up to the trellis. New growth is encouraged above this point only.

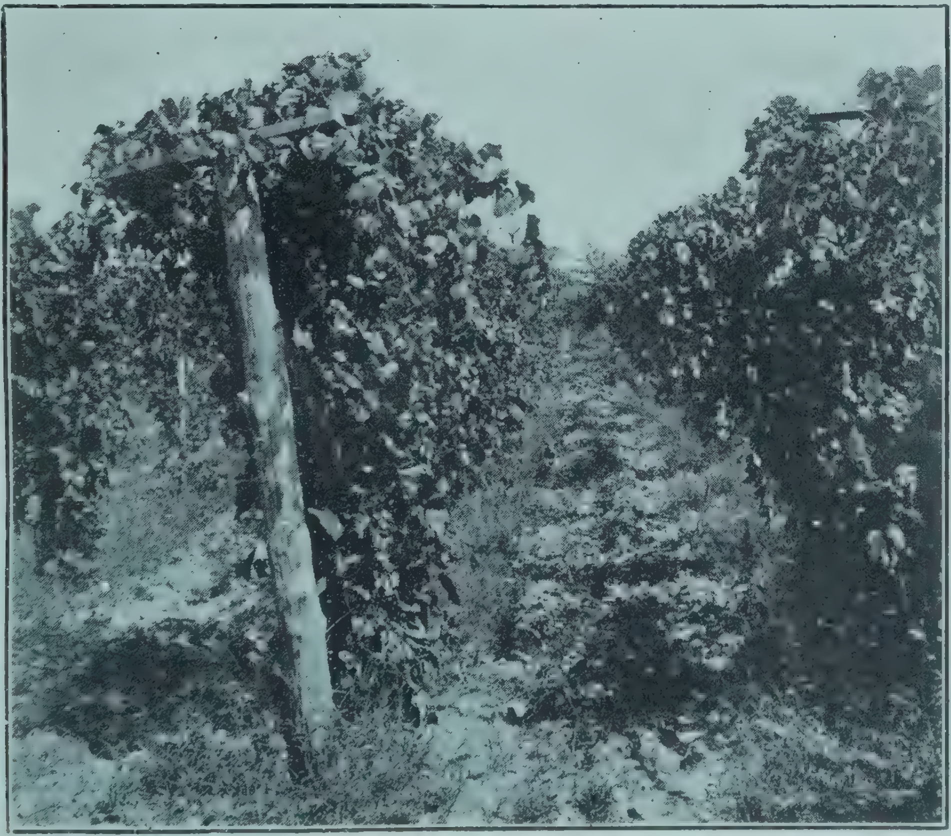


Figure 4. Vines trained by the Munson system. The fruiting canes are trained to run horizontally along the two wires; this permits the young shoots containing the clusters of fruit to hang down in a natural position.

grape before they are sprayed, neither the bags or spraying will do any good.

The varieties to be planted will depend upon the locality and the owner's taste. For Central Missouri, I would name Eclipse, Cottage, Green Mountain, Worden, Concord, Wilder, Niagara, Charlton, Herbert, Agawam, Moyer, Merrimack and some others. For home use, I like to have more varieties than are advisable for market. With many varieties, one is surer of having grapes every year than where only a few sorts are grown, as it sometimes happens that one or more varieties will fail to bear. For home use, the varieties having the best flavor should have the preference over others that may be more hardy or productive. Even for market, quality should be considered, and is now being considered by consumers more and more as the years pass by and fruit becomes more plentiful and the public better educated in the matter of quality in fruits. The following is a description of varieties in the order of ripening: Moore's Early, black in color, large in bunch and berry, a good kind for market where a large, early variety is wanted; not as good as others before named, therefore, not recommended for the home vineyard. Anyone undertaking to grow this variety should prune for small canes on laterals, as it is one of the varieties that will not fruit satisfactorily if the canes are too large.

DESCRIPTIONS OF VARIETIES.

The following notes will give some idea what some of the leading varieties are like:

Eclipse: Black in color, and the earliest I have ever fruited, and of the highest table quality. A most excellent keeper, remaining on the vines in good condition for a month after it is ripe, a trait possessed by no other early grape. Cottage: Black in color, a seedling of Concord; good grower and bearer, early, good quality, not good for shipping, as it is apt to drop from the bunch after being picked a few days, but a good second early sort for home use and local market. Green Mountain: White in color; the earliest white, small berry; of excellent quality, but not to be recommended for market. Worden: Concord type, but earlier and better in quality; also somewhat larger. Has the fault of cracking in wet weather, even more than Concord. Concord, of course, should be in every collection; everybody knows what it is, and were one to leave it out of the list, there surely would be protests. There are more vines of this kind sold and planted than all other varieties combined, yet it has its faults, and I hope to see it superseded by something better. Moyer: A small, red grape, of good quality, but not large enough to be desirable for market. Agawam: Red; one of the Rogers hybrids; a variety that has been strangely overlooked; should be in every collection. Niagara: The best of all white grapes; in fact, I think it has more good points than any other grape yet tested of any color. A good healthy grower, abundant bearer, bunch and berry large and of excellent quality; should be in every vineyard, whether for home or market. Merrimack: Black; also one of the Rogers bybrids that is not valued as it should be; a good healthy grower, productive and of good quality. Wilder: Black; is also a Rogers hybrid, larger in bunch and berry than Concord; of very good quality, and never cracks, no matter how wet the season may be. Apt to overbear; therefore needs severe pruning and thinning. Charlton: Red in color. This is a new sort; good grower, productive, of the very highest excellence, having a peculiar aromatic flavor somewhat similar to Goethe, but is far more healthy of vine and foliage. Herbert: Another Rogers grape, black in color. Good grower and bearer, of good quality and one of the best keepers that we have; recommended on that account. There are other varieties that are good, but the foregoing list will give grapes from the earliest to the latest.

It may be expected that I say something about the McPike, it having originated in my vicinity. It is very large and sure to attract attention wherever exhibited and is of very good quality, too. It, however, has some very bad faults. It is not a robust grower, and is exceedingly inclined to overbear. The worst faults of the McPike are, first, that it does not ripen evenly on the bunch, there being green and red berries on the bunch at the same time, and, second, it cracks badly; in fact, worse than any other variety I have cultivated. Only to be planted for show purposes. It is the largest of any of the grapes mentioned on this list.

I have tried many different methods to keep grapes, but with rather poor success. In our latitude they ripen too early to keep well. The best success has been had by leaving them on the vines in sacks until danger from severe frost, then placing them in thin layers in a cool and not too damp place.

The grape is such a good fruit, comes into bearing so soon, and will grow wherever there is enough soil to place the roots in, that everybody should plant them. Any owner of land, be the same a farm or only a city lot, who fails to plant grape vines, is not living up to his privileges or doing his duty to his family.

DISCUSSION.

Major Holsinger—I should like to know of the origin of the Eclipse.

Mr. Riehl—It is a seedling of Norton and Cynthiana, and has hence the following characteristics: High quality, remains on the vines for a long time, has excellent foliage and is somewhat of a slow grower. The old foliage will hold on vines longer than any other kind. It is a very fine grape.

Major Holsinger—Compared with Moore's Early, is it as early?

Mr. Riehl—Yes, even earlier than this variety. Another nice thing about the Eclipse is that it is such a good grape to eat. The quality is excellent. This is not so of Moore's Early.

Mr. Darsche—Have you tried the Chicago?

Mr. Riehl—No, I have not tried this variety. I do not think it has the quality. That is the worst mistake fruit growers can make—that is, to grow poor fruit and put it on the market and force the consumer to take it. If you have fruit of a good quality, you can create a market where there is none. Keep your good stuff for the market and your poor stuff leave at home.

Mr. Darsche—How about the Woodruff?

Mr. Riehl—It is not a very reliable bearer. I do not like the quality.

Mr. Irvine—What about the Brighton?

Mr. Riehl—It has very poor foliage. Will not stand up well.

Mr. Stark—Tell us about the Lindley.

Mr. Riehl—It is a very good grape, but does not set fruit well. It needs close pollination, which is the one bad fault about it; is a good keeper and very good quality.

Mr. Miller—How about the King?

Mr. Riehl—I was unfortunate about the King. Have not succeeded the best with it. However, I might say that I believe it to be one of the best of our large black grapes. It is not quite so large as the McPike. It ripens early. The grapes are larger than the Concord, but you cannot ship them, because the pulp is so tender.

Mr. Miller—What have you to say about the Morlan, the improved Concord?

Mr. Riehl—It is a little larger than the Concord. I would grow both of them. The Concord has some value. It is all right farther north. With us its greatest fault is that it does not hang well on the vines. I have a great many seedlings. Eclipse is one of them from the Niagara.

Mr. Miller—For a late crop, what grape do you recommend for home use. How about the Goethe?

Mr. Riehl—This grape does very well in this section. I believe I should plant the Charlton or Herbert.

Mr. Darsche—Is there not a tendency of the Charlton to overbear?

Mr. Riehl—The easiest way of overcoming tendencies of overbearing is by the use of the pruning shears.

Mr. Miller—I have plenty of ashes and can get plenty of manure. Can you use them in combination? Would you use one and dispense with the other?

Mr. Riehl—That depends on the condition of the soil. I believe that we have enough potash for grapes in this section. I would not use very much ashes. The use of manure depends also upon the soil. I do not want too much manure on grapes.

Mr. Miller—I was experimenting, and wanted to see how long a growth I could get out of the grape. The vine grew to the length of 38 feet.

Mr. Irvine—You spoke of the Agawam. Is it hardy?

Mr. Riehl—Yes, it is a hardy grape. You understand that I am speaking for the climate in the vicinity of Alton, Ill.

Mr. Holsinger—My choice of table grape is Wyoming Red. Have you experimented with it?

Mr. Riehl—Yes, I have grown this grape. It is very much like the Moyer. I find it gives a good crop, although it is a small red grape. When I started this grape culture, several years ago, I had one thousand seedlings. I saved about twenty out of the thousand. Out of this twenty I only got Eclipse. I got some grapes of excellent quality, but something was the matter with all—all but the Eclipse. I believe the Eclipse will live longer than I will. No. 15 never set a good bunch. I took seeds from it, and from it I got one that I believe is a good one. It is all right in every respect.

Mr. Stark—What became of your Black Niagara?

Mr. Riehl—It was one of the seedlings I chose, but it had some defects, although it also had some value. I think the Department of Agriculture is experimenting with it now.

HOW THE FRUIT GROWER DEALS WITH THE INSECT PROBLEM IN COLORADO.

(By E. P. Taylor, Entomologist, Missouri State Fruit Experiment Station, Mt. Grove, Mo.)

It is not probable that this subject has been assigned me without having as its object a description of those methods of insect control practiced by Colorado fruit growers which might be suggestive of measures possible for Missouri orchardists to follow. It is also not to be assumed that the writer would suggest that fruit growers in this State should adopt practices of the West without alteration and adaptation to suit conditions with which we are surrounded. I believe, however, that there are valuable lessons to be learned from finding out how other fruit growers meet their orchard problems. If we live entirely to ourselves, without regard to our competitors' methods, we are likely to soon find our competitor greatly excelling us in the quality of his product and in the financial returns realized for it. This is especially true of commercal fruits which find their way into distant markets, to meet strong competition from other points. If we find upon the markets from other states fruits which have been protected against insect injury by spraying, and which fruits, on account of their freedom from insect blemishes, sell for prices which net the grower far greater returns than do ours, cannot we afford to inquire into the methods which have been responsible for the difference?

There are many natural conditions which favor fruit growing in Colorado, conditions which, at the present time, are assisting the orchardist without any special effort upon his part. For instance, he does not have to contend with the many fungus diseases, such as apple scab, bitter rot, apple blotch, peach scab and brown rot. These are unknown to the orchardist of Colorado, and the use of the Bordeaux mixture is, with but few exceptions, entirely unnecessary. Spraying operations are consequently directed almost wholly toward the control of insects. There is probably no district in the United States where more systematic spraying for insect control is carried on. There the aim of the orchardist is toward the production of as great a ratio of high grade fruit as possible. It is due to the universal practice of spraying more than to any other single effort on the part of the orchardist that the state has attained her wide reputation for extra fancy fruit upon Eastern and foreign markets. In the principal fruit belts of the state orchardists who do not spray are as rare as farmers in this locality, who grow profitable corn crops without any cultivation. To encounter an orchardist in the better Colorado fruit sections who unqualifiedly doubts the value of spraying would be so exceptional that the man would almost be marked in his community as a curiosity.

Before going further let us consider the insect pests with which the fruit grower in Colorado is concerned. I have made a list of forty of the most injurious insects from which I found the fruit growers in different sections suffering more or less injury. This number is drawn from those infesting orchard fruits proper, and does not include the many insect pests of grapes, strawberries, bush fruits and cantaloupes. It will be seen that the fruit grower in that section is by no means exempt from injurious orchard insects. These forty injurious species are divided as follows: Eleven are injurious kinds of plant lice infesting the tree either above or below ground; four are scale insects, infesting principally the bark, but sometimes showing upon the fruit; five are borers as larvae or adults in the tree or in the twigs; four are mites which infest the leaves or buds. These, although not true insects, being here listed; three are insects injurious to the fruits only, and the remaining thirteen species in the list are miscellaneous feeders upon the foliage of buds of various fruits or those which, in the process of depositing their eggs, damage the twigs.

These do not represent all the insects likely to be found in Colorado orchards, nor is it to be expected, on the other hand, that all would be found causing trouble in any single locality. Some of these listed, though common in certain districts east of the Rocky mountains, are not destructive in the valleys devoted to fruit growing in the territory spoken of as the Western Slope of Colorado. Some are very serious pests, requiring constant combative measures, while others are periodic in nature, requiring treatment in certain years.

It is often said that the insect problems in Missouri are not the ones of Colorado, but I was surprised to find that 90 per cent of the forty most destructive Colorado fruit tree insects are also to be found among the noxious insects of Missouri. We, therefore, have a common interest in nearly all of the remedies employed against fruit insects of the West. The orchards of Colorado being for the most part those planted within a score of years past, are naturally not beset with as many kinds of insect pests as are the orchards in any of our older states. The people of Missouri, for instance, are obliged to fight San Jose scale, plum and apple curculio, apple leaf crumpler, cherry or Forbes scale, apple twig pruner and oyster shell bark louse, none of which have to my knowledge ever been reported upon orchards in Colorado.

There are some insects common to both Colorado and to Eastern orchards which have been much more destructive in the West than in Missouri. If the Colorado fruit growers had not taken up spraying against them and carried it on intelligently and persistently, commercial fruit growing would have had to be abandoned in Colorado before now. Notably among these most destructive insects have been the codling moth and several species of orchard plant lice.

My remarks would be incomplete without reference to the way codling moth is there handled. This insect is preeminently the worst infesting the fruit itself in the state. In one season of the writer's experience in Western Colorado the arsenical spray mixture alone in a single county cost the growers over $36,000.00. The arsenicals used for codling moth spraying are principally arsenite of lead and arsenite of lime, with a preference for the former. The formula for the commercial arsenite of lead has, upon the average, been from two to three pounds of the paste lead per fifty gallons, though of recent years the tendency has been toward a weaker dilution. Fruit growers pay special attention to the application of their sprays at the proper times, and although not many years ago as many as eight or ten sprays were often applied in the season, the insect is now being controlled completely in many orchards with but two to four applications. The first spraying is applied when the calyx lobes are beginning to draw together into a tube-like basin, at which time they will hold the largest amount of spray. The spraying must be done before the calyces close, and this spraying is considered by far the most important of all sprays given. A rather coarse spray is used, and with a high pressure, 150 to 200 pounds or more, the liquid is driven directly into the basin. Since the spray is one of an arsenical without Bordeaux mixture more can be applied without danger of burning the foliage or fruit. Spraying is done from an elevated platform as well as from the ground, since upon an average tree about two-thirds of the blossoms point upward and one-third in a downward direction. Long spray poles are used generally by those doing the best work.

Since sometimes as many as one-third of the first generation of worms do not enter at the calyx end, but at the side of the apple, a second treatment given as a fine mist spray is deemed necessary, and this is applied about one month from the time the trees are in full bloom. This will be at the time the apples are about three-fourths of an inch in diameter and will be when the first eggs of the moth are being laid. A third spraying is given about two weeks following the second, at which time the maximum number of the first generation of eggs are being laid. Some growers prefer to defer their third spraying until about one month following the second, and at that time it is given when the first eggs of the second generation of moths are appearing. The tendency of the more successful orchardists is decidedly toward more thoroughly spraying for the purpose of destroying the first generation of worms, thus intercepting the later ones. The orchardists of Colorado are not satisfied with mediocre results. I have seen orchards sprayed after the plan above given which gave 99 per cent of the picked fruit free from codling moth injury, while improperly sprayed orchards adjoining gave nearly three-fourths wormy. So severe is codling moth injury in cases where no spraying is done, that I once picked up a thousand windfall apples of which 995 were wormy and in which I counted 3,112 worm holes, and I have counted as many as sixteen worm holes in a singe apple. In spite of this condition, the majority of fruit growers in Colorado have ceased to manifest any great alarm over the codling moth, since they have learned to spray, and spray thoroughly, at the right time and with the right material. At this time there is considerable discussion as to whether the Western methods of spraying for the codling moth are applicable in the East, and it may be of interest to say that this summer, in an apple orchard in the Ozarks, the writer succeeded, by employing such methods, in securing 97.4 per cent picked fruit free from both codling moth and curculio, with the application of only three early sprays, and from 3,419 apples only six showed injury from codling moth. In an unsprayed orchard 53.9 per cent of the picked fruit showed injury from curculio and codling moth, mostly from curculio. This experiment at least affords good and encouraging evidence that Western methods applied to spraying for codling moth in this State will bring equally successful results.

Another insect pest against which the Colorado fruit grower has had to wage an expensive but successful warfare is the wooly aphis of the apple. Ordinarily, this insect is one infesting the roots of the trees only, or occasionally to be seen upon scars of the tree above ground. Two years ago in Western Colorado the pest became so abundant that not only were the roots attacked and gnarled, but branches in the tree tops also became infested, until they were completely whitened from the wooly secretion over the bodies of the lice. The leaves were attacked, and the fruit, after becoming coated over with the sticky honey-dew excreted from their bodies, was rendered so unsightly that each apple had to be cleaned by hand before packing. The crushing of the bodies of the insects against the fruit pickers ruined their clothing, and irrigation water in ditches flowing through the orchard in the summer had its surface covered with the bodies of the floating lice. In the fall, when a general migration of the lice from tops to the roots took place, a bluish heap of living aphids would be found in a circle on the ground at the crown of the tree. Although natural insect parasites, such as lace-wing larvae, lady beetles and surplus fly larvae, did much to reduce the aphids, the fruit growers also applied every available method of control.

At first they resorted to the use of tobacco dust about the base of the tree, worked into the soil about the roots. Although the growers in one county during the years 1906-07 applied over 200,000 pounds of tobacco, principally as dust, upon the whole the results proved unsatisfactory. Much of the dust, secured at a cost of 2 cents per pound, was found, by examination, to be 62½ per cent pure sand by actual weight, at which rate the growers were paying 5 and 1-3 cents per pound for the actual tobacco purchased. A few growers undertook the growing of their own tobacco for insecticide purposes, and the ground tobacco stems or pure tobacco leaf was purchased and secured in this way a purer product. In the season of 1907 kerosene emulsion was also used with great success in the summer as a tree top spray, when an emulsion containing from 5 to 7 percent oil was used, and in the fall and spring the roots were exposed and treated with a 10 per cent kerosene emulsion, using precaution to avoid injury to the trees. In Mesa county in 1907 fruit growers used about 50,000 gallons of a concentrated emulsion which, with an average dilution, made about a half a million gallons of insecticide. A local spray manufacturing company at Grand Junction made a portion of this in a wholesale way in a large steam boiling plant for the growers. One orchardist applied about 40 gallons of kerosene upon his 40-acre apple orchard, using it as a 6 per cent spray, and another grower applied $1,500 worth of the emulsion upon his 100 acres of apples with splendid results.

Solutions of tobacco were also used in 1907 with striking success. These were found successful as root treatments as well as top sprays when made by steeping for two hours one pound of strong tobacco leaves or two pounds good dust or stems in four gallons of water. One of the best forms of tobacco used for this purpose and against other aphids was the commercial "Black-Leaf-Extract of Tobacco," formerly used as a sheep dip. It was used at a strength of one gallon per 65 gallons of water, and has the advantage of being capable of mixing with arsenical summer sprays as well as being quite safe to use upon the foliage. Although its penetrating powers through the coating of the wooly aphis was less than that of the oil emulsion spray, it was used in great quantities, more extensive, perhaps, upon the green apple aphis. In Delta county in 1907 it was estimated that fully 500,000 gallons of the solution was applied to fruit trees as an aphid spray. As a root treatment, any of the tobacco sulutions proved greatly superior to the dry dust or stems.

The green-peach aphis, the black-peach aphis and the green-apple aphis, all familiar insects to the fruit growers of Missouri, cause the fruit growers in Colorado some trouble, and, in fact, there seems to be an abundance of injurious species of plant lice to harass the fruit growers in that state, due, perhaps, to the dry atmosphere especially favoring the aerial forms. For many of these aphids, such as the green-apple aphis, which winter as eggs upon the tree, hatching at about the time the green leaves are put forth, sprays of the standard lime and sulphur wash, such as is used so universally against the San Jose scale in states having this pest, are used. This spring spraying with lime and sulphur is a regular practice with orchardists in many sections, especially on pears, for the Howard scale and different species of pear mites; on peaches, for peach twig borers, and on young apple orchards for the spring hatching lice.

In Colorado, although many car loads of sulphur are used by growers in the fruit section for the making of their own home-made lime-sulphur wash, there is a strong tendency to use the ready-made commercial lime-sulphur wash. There are many cars of these lime-sulphur sprays, principally the Rex limesulphur, used annually in the state, which, when used strong enough, has given splendid results. This same tendency of the fruit growers to use ready made commercial sprays is seen in the popularity of the commercial tobacco dips and oil emulsions.

No evidence showing advancement and progress in fruit growing speaks any better for a horticultural community than the possession and intelligent use of spraying apparatus. Scarcely an orchard in the better fruit sections of the state is not equipped with a spray pump, varying from the hand-barrel pump to the improved gasoline power outfit. Twenty acres of full bearing apples are considered as much as one power outfit can spray thoroughly and at the correct time. In some communities one power outfit is made to do the spraying of several five and ten-acre tracts. The fruit section lying in the Grand valley surrounding Grand Junction and within a radius of twelve miles has the reputation of having for orchard spraying more gasoline power outfits than any equal area in the world. In this territory there are more than 200 power outfits, while the county of Mesa possesses spraying equipment for insect control costing upward of $100,000, and the most encouraging feature of the situation is that these are used whenever necessary. As evidence that they are used regularly and as they should be used by progressive orchardists in any locality, let me give you the figures of the amount of arsenical sprays used in Mesa county in the summer of 1906, the figures being compiled from the books of the six co-operative fruit growers' associations selling all produce and purchasing all supplies, including insecticides and spray apparatus, for the growers of that county. The amounts of arsenicals used were: Arsenate of lead, 195,000 pounds; white arsenic in mixing up arsenite of lime, 36,640 pounds; other arsenicals, 1,200 pounds; making a total of 232,940 pounds, or about seven and three-fourths car loads. If to this the sal soda and lime necessary in preparing the arsenical mixtures for spraying are added, the material used aggregates about forty-seven car loads, or enough arsenical mixtures to amount to more than 53,000, 200-gallon spray tanks of liquid. It was estimated that for the year in which these figures were gathered about sixteen car loads of commercial arsenate of lead were sold to Colorado fruit growers. The fruit growers using this material struck a balance at the close of the year after having received the returns for their fruit, and found that it paid—yes, paid them five, ten or twenty fold. The figures given will serve to show, I hope, the way the fruit grower is dealing with the insects which have already settled in Colorado.

And lastly, the fruit growers in Colorado have already wisely taken steps to reduce to a minimum the introduction from other states of dangerous insect pests and fungus diseases by the enactment, two years ago, of a state nursery and orchard inspection law, which became effective January 1, of this year. The importance of such a measure to Colorado fruit growers becomes apparent when we realize that the state is one of the few remaining ones in the Union where the San Jose scale has never been found. This law also provides for the compulsory inspection each year of all nurseries within the the state, and the fumigation of such stock, whether shipped to points within the state or to points without. The Colorado law also provides for a rational system of control of the insect pests within the state where property is being damaged from its proximity to that dangerously infested. The execution of the law is placed in the hands of a competent entomologist, with full power for its enforcement.

HOW THE INSECT SITUATION HAS BEEN HANDLED IN ILLINOIS.

(By Prof. J. A. West, Assistant State Entomologist, Urbana, Ill.)

Mr. President of the Missouri State Board of Horticulture, Ladies and Gentlemen:

It is unfortunate for you that Professor Forbes, the Illinois State Entomologist, can not be present at your meeting to address you, since he is a man of extraordinary ability and wide experience. However, since under his direction I have been in charge of the operations of the State Entomologist's office under the horticultural inspection law, he has sent me as a substitute. It seems to me that I can do nothing that will be more profitable than to relate a bit of the history of the development of our inspection system.

The San Jose scale was discovered in Illinois in the fall of 1896. The State Horticultural Society, by a vote of its executive board, requested Professor Forbes to undertake extermination of the pest at Quincy, where it had been found, and appropriated an amount not to exceed one hundred and fifty dollars for this purpose. Presently, however, more centers of infestation were discovered, and as these were examined, one by one, it was found that there were some points in Illinois where the San Jose scale had gained such a foothold as to make its extermination at these points a matter of exceedingly great difficulty.

For the most part, the relations between the State Entomologist, or his assistants and the orchardists having infested fruit trees, were most pleasant, and the two parties worked together, each helping the other as far as possible. Sometimes, however, inspectors were forbidden to enter private properties for purposes of inspection or to treat infested trees, and since there was no law authorizing these inspections, they were often made at serious disadvantage, at times being almost impossible. The faithful and persistent efforts of Professor Forbes and his assistant inspectors during the years prior to the passage of the horticultural inspection law, considering the difficulties encountered, were nothing short of marvelous.

A movement was put on foot to secure the passage of a law by the legislature of 1897. This effort failed, and during the succeeding period of two years the necessity of the inspection of nurseries became so very necessary for the interstate shipment of nursery stock, that a law was passed by the legislature of 1899. Under this law the State Entomologist was required to inspect, by himself or assistants, all orchards, nurseries, fruit plantations, grounds and buildings used for the packing or storing of fruits, whenever he had reason to believe that they were infested by the San Jose scale, or other dangerous insects or contagious plant diseases. This law also provided that the State Entomologist should disinfect once thoroughly all trees known to be infested by the San Jose scale at the time of its passage. Trees becoming infested at a later date were to be treated according to the direction of the State Entomologist, or he was authorized to make the necessary insecticide application, assessing one-half the cost of the treatment to the owner. These provisions relating to the orchard inspection and treatment were faithfully executed by Professor Forbes, with a result, as we now look back upon the experience, of being of a vast amount of benefit to Illinois horticulture.

The idea of treating the orchards known to be infested at the time of the passage of the law, without expense to the owners, had this disadvantage; that in some situations the orchardists depended upon this single application of insecticide to permanently protect their property from reinfestation. Or in other situations the owners of infested orchards, it seemed, would deliberately neglect to follow up the treatment made by the State with further applications of insecticide during the succeeding years, depending, it would seem, upon the State to again treat their orchards without expense to them when they became badly infested. There is no excuse on the part of the parties who neglected their orchards on account of the two conditions mentioned, for the situation was certainly made perfectly clear to them. On the whole, however, it can be said that the provision of the law which applied the insecticide free of expense to the orchardist was in general beneficial in its effect, but not as completely so as was expected.

The further provision of the law, which assessed to the owner of the infested fruit trees one-half the expense for their treatment, such trees having become infested after the passage of the law, was found by experience to be quite unsatisfactory. Although the expense of treatment by State spraying parties was practically always in excess of what would have been required had the owners done the work themselves, when this expense was divided by two, the State bearing one-half, the owners paying the other half, the expense of the treatment was not sufficiently felt by the orchard owner.

Orchard insecticide operations, made under the law in situations where the owners were neglecting to treat their infested trees, always had, however, a splendid effect upon the community, especially if there was more or less opposition on the part of the owners of orchards to the treatment by State spraying parties. In some places it acted as a decided tonic to the community, arousing them from indifference and lethargy, and in many communities where such operations were carried on by State spraying parties the effects were lasting, for a large majority of the orchardists in these communities, having learned the necessity for the operation, continued to actively treat the infested fruit trees on their own account.

The provisions of the law of 1899 relating to the inspection of nurseries were fairly satisfactory, there being but one serious defect, that being that the law was so worded as to make it difficult to hold a nurseryman responsible for violating conditions prescribed by the State Entomologist. The nursery inspections were made and the expense of the inspections assessed to the nurseryman whose stock was inspected.

The law of 1899 stood unmodified until it was superseded by the revised act of 1907. The prominent features of the revised law are, first, that the State Entomologist shall inspect and prescribe treatment for infested orchards as under the previous law, but in case spraying operations are necessary by State spraying parties, the entire cost of these operations shall be assesed to the owner of the trees treated. This step you will see is an important advance. Under the former system, an orchardist might neglect the treatment of his trees indefinitely, and if finally the State spraying party did come around and apply the insecticide, he would have to bear only half the expense of the operation, making the cost of the application to him exceedingly moderate. Under the present system, where the orchardist must pay the full expense of the treatment, and the expense of State spraying parties is in excess of that by the orchardist himself, this bill of expense serves in a measure as a penalty for failure to observe the conditions prescribed by the Entomologist. Where persons have paid one bill of expense of this kind and are notified again of the necessity for treatment, they will not wait for the State spraying party to come to do the work, but will undertake the treatment and have it out of the way before the time limit of the notification has expired. That has practically been the effect of the working of the law.

With regard to nursery inspection, the present law provides that any violation of an agreement on the part of the nurseryman with the State Entomologist shall be deemed a violation of the act, and this, of course, makes it possible to prescribe conditions which, if not observed, render the negligent or refractory parties amenable to the law. The present law provides for the registration of nursery agents and dealers who may become a source of trouble in any of our states.

I could give you in some detail an account of the spread of the San Jose scale in Illinois, with a good idea of the present status of infestation. I could also trace the history of the struggle to find a suitable and satisfactory insecticide for use in controlling this infestation. I shall, however, merely state that where the lime-sulphur wash has been properly prepared and thoroughly applied under anything like favorable conditions, the results have always been satisfactory.

Since Illinois is becoming year by year more generally infested by this pest, the matter of inspection becomes a heavier burden and more complex. At present the organizing of spraying parties for operations for a month or two in the fall, which must be abandoned during the middle of the winter, their reorganization again in the spring, only to disband them about the first of April, makes the matter of operating State spraying parties quite difficult, and with the amount of work that needs to be done in Illinois each year, and with this amount increasing, it seems that we will have to look, in the course of time, to some other method of handling our problem. For instance, during the last two years the State Entomoligist has insisted that every fruit tree, shrub, hedge, or other property known to be infested by the San Jose scale and situated within one-half mile of any nursery, shall be treated, if necessary, by State spraying parties. Such operations, requiring as they do organization for thoroughgoing, and at the same time rapid work for a time in the fall, a reorganization for spring spraying, makes the management of any such program exceedingly difficult, and it would seem that the only rational solution is the enactment of a law which will provide that the disregard of a notice sent out by the State Entomologist to an orchard owner to treat infested fruit trees shall be followed by a fine; a second notice of a similar character disregarded would be followed by the destruction of the infested fruit trees by the Entomologist, the expense of the operation to be borne by the party for whom the trees were destroyed.

In the operation of an inspection system in any state, it seems to me that the fundamental thing shall be that the inspection authority shall be vested in a central power of such strength and dignity that it will be respected. The law should provide for the inspection of orchards and nurseries, possibly completely at State expense, or it might be that the nursery inspection would not be looked upon as necessarily a public benefit, and the expense of the nursery inspection be assessed to the nurseryman. Violations of conditions prescribed by the State Entomologist shall be considered a violation of the law. The State Entomologist should have control of his certificate of inspection after it has once been issued. The law should include a regulation of the transportation of all nursery stock by common carriers. It should provide a suitable penalty for violation. On the part of the public, it should provide for the right of appeal.

Give the Entomologist power, but make certain that the people will have fair play.

DISCUSSION.

Mr. Todd—What about the inspection of forests under your bill?

Mr. West—Forests will not be touched under this law. The bill did not provide for that, because it would be almost impossible to fight the San Jose scale in the forests were they infected, and also the forests are not apt to be infected so soon as the orchards are.

Mr. Todd—Who had the enforcing of this bill in charge?

Mr. West—The Entomologist to the Experiment Station or State Entomologist. The enforcing is really an act of the community itself. No one man can say that he will not spray when so notified to do so by the inspector. The work has been very burdensome in some cases and sometimes it was very hard to enforce this law, but among the better class of horticulturists we have had little or no trouble. They want to control the scale, and want their neighbors to control it.

Mr. Culp—What about the infection of the Osage Orange? Do you consider it more easily infected than fruit trees?

Mr. West—Yes, the Osage Orange is very easily infected, and in most instances where we have made an examination, we have found the plants lousy with the scale. However, it is easily controlled on the Osage Orange.

Mr. Culp—Does the scale spread rapidly?

Mr. West—Yes, one infected orchard is a menace to the entire country. The easiest way to control the scale is to find it when it starts in a locality, and do not let it get out of that orchard.

Mr. Culp—You might tell us some of your experiences in enforcing this law.

Mr. West—No, I had better not do that. Most Illinois farmers are lawyers.

THE LEADING INSECT PROBLEMS OF THE YEAR.

(By Prof. J. M. Stedman, Entomologist, Missouri Agricultural Experiment Station.)

In making a general survey of the entire State of Missouri with regard to the more important injurious insects during the past year, it will perhaps be a surprise to you, as horticulturists, to learn that, taking all farm crops, the insects do more damage to garden vegetables than to any other crop. Field crops, especially corn and wheat, come next; live stock third; fruit insects fourth; forage crops fifth; and shade and forest trees next. Hence it seems to me that the horticulturists have great reason for feeling somewhat satisfied with regard to the injurious insects.

While it may be unpleasant to note, it nevertheless is a fact, that in general the horticulturists, and especially the orchard fruit men, do not pay the attention to this matter of controlling insects (and the same is true of fungus diseases) that we find our neighbors in the West and in the East doing. To anyone from Missouri visiting these eastern and western fruit regions, it will be a great surprise to see the extent and thoroughness of the work those horticulturists are doing along this line, and the money and time that they devote to it.

If we, as horticulturists of Missouri, are to compete with the fancy and first class fruit on the market in the better centers of the United States or Europe, we must pay more attention to this matter of fighting insects and fungoid and other diseases. In the East and West, horticulturists with from ten to twenty-acre orchards will not rely upon a hand pump in many instances, but will pay $300 to $350 for a gasoline spraying outfit, which will give them a pressure from 150 to 200 pounds per square inch, thus enabling them to do very much more effectual and thorough work than can ever be accomplished by our hand-pump methods. If a man in New York State, where land is much dearer than it is here, purchases a $325 spraying outfit for his ten-acre orchard, certainly we horticulturists here in Missouri, with our hundred-acre orchards, can afford to spend the same for a pump. I happened in a town of only about 2,000 inhabitants in Western New York, and on entering the little hardware store, was surprised to find in there a complete gasoline spraying outfit, mounted on wheels. I inquired how it happened that such an outfit was kept there, and was immediately informed that three of them had been sold that day, and that they were continually selling such outfits, keeping them in stock for the purpose. I know of no town or city in Missouri where such a trade in these high priced spraying outfits is to be found.

In the West, orchardists are successfully combating the codling moth with one, or at most two, sprayings, while here we are using, as a rule, four sprayings. This means that we are spending twice as much for fighting this insect as are our neighbors in the West. It seems that this difference is due largely to the thoroughness with which the orchards are sprayed in the West, and to the fact that a stricter adherence to the proper time to spray is observed. It is no doubt true that we could lessen the number of applications for this insect by the use of power machines and by applying the mixture with a great deal of force, using a coarse spray, applying it from above, instead of from below or at the sides as we have always been doing, and by applying it thoroughly, drenching the trees, within five days after the blossoms fall, using for this purpose arsenate of lead, which substance has the property of remaining upon the plants a much longer time than the other arsenical poisons. The idea is to fill the calyx end of the apple cup while it is open and before it closes or the apple turns down. If this is properly done, the greater part of the work of fighting this insect has been accomplished. We are not, however, to lose sight of the fact that here in Missouri we have usually many severe rains just at the season when spraying for the codling moth has to be done, while our western neighbors do not have many severe rains to contend with at this time. However, this cannot account for all the differences to be observed in the two regions.

The San Jose scale, unfortunately, is on the increase in Missouri, and the time is soon coming, when in a great many localities, it will be necessary to spray regularly for this insect, thus adding more expense to the maintenance of an orchard. It is impossible to even think of exterminating this pest, and we should take a philosophical view of the situation, and simply regard it as one more case of a pest that must be reckoned with, the same as the codling moth, curculio, and other insects. Fortunately, we now have several very efficacious and cheap methods of controlling this insect, so much so that in ordinary orchards, one thorough spraying once in two years, or at least not oftener than once each year, will hold this insect in check so completely as not to cause us any loss, other than the cost of spraying.

In fighting the San Jose scale, it has been observed that one keeps in check to a certain extent many other insects, and also, if the lime and sulphur wash is used, certain fungoid diseases as well. An orchard sprayed for the San Jose scale certainly has a much healthier and better appearance than one not so treated. It may be surprising to the most of you, but it is a fact, that we can now control the San Jose scale much more efficaciously and cheaply, and with more certainty than we can the codling moth, or the plum curculio in the apple orchard.

The home-made lime-sulphur wash is still the cheapest method of fighting this insect and is as efficacious as any. It is difficult, however, to prepare, and unless one has a large amount of spraying to be done, and has some means of making it, some other substances, to be given later, may be more profitably used. The lime-sulphur wash is made by boiling together for at least three-quarters of an hour, 15 pounds of good fresh stone lime and 15 pounds of sulphur in a quantity of water, stirring it up occasionally during the boiling. After it has boiled sufficiently, which should in no case be less than three-quarters of an hour, enough hot water should be added to make the whole up to 50 gallons. This substance must be applied to the trees while hot, and like the other insecticides for the San Jose scale, must be applied only after the leaves have all fallen and before the buds start in spring—in other words, while the trees are absolutely dormant.

Where one does not wish to go to the trouble of making this lime-sulphur wash, we now have upon the market a number of miscible oils which give practically as good results, so far as killing the insect is concerned, and although they cost, on an average, twice as much as the home-made mixture, yet the saving in time, trouble and expense of boiling, and the fact that the miscible oils are always ready for use at a minute's notice, makes them very advantageous substances for the San Jose scale work.

These miscible oils are proprietary substances, and while we have a great many on the market, three at least have, by experimentation in various places and at various times, proven satisfactory, and for your benefit it might be well to call your attention to the three such preparations: Scalecide, Kill-O-Scale, Target Brand Scale Destroyer. These substances are to be applied while the trees are dormant, and are used in the proportion of one gallon to 15 gallons of water. It is not necessary to use hot water, and they will readily mix wtihout any preparation other than a thorough stirring.

The oil costs about 50 cents a gallon, which figures, on ordinary 8-year-old trees, about three cents per tree, while the homemade lime-sulphur wash figures out about one and one-half cents per tree.

Unfortunately for Missouri, we do not yet have a law requiring inspection and controlling the sale of nursery stock grown within the State. This is to be regretted, since we have a few cases where nurseries in this State are infested with the San Jose scale. They thus become a menace to the horticultural interests of this State, and laws should be enacted by this legislature controlling these matters. We now have a State Board of Horticulture, and if the State Legislature will pass a bill establishing the office of State Nursery Inspector, under the control of said Board of Horticulture, and will pass suitable laws regarding this matter, it will save the State an untold amount of money in the near future. For several years we have had similar inspection of live stock by a State Veterinarian, under the control of the State Board of Agriculture, and this nursery inspection will simply place the plants of the State on the same footing as the live stock.

It is not necessary to say anything in regard to the codling moth or plum curculio, the two other most troublesome insects in regard to orchard fruits.

DISCUSSION.

Maj. Holsinger—In the distribution of nursery stock, is the present law sufficient?

Prof. S.—No, the law provides for interstate inspection, but not for State inspection.

Prof. Taylor—While we are on the subject of inspection, I wish to say that experiments for the past two years have been conducted in sections where San Jose scale was prevalent. In the meeting held a year ago, I gave you something of the plan. Many sections of the State have held demonstrations of spraying. In one section where no spraying had been done we went into that section and conducted a demonstration and the following season 2,000 trees were sprayed. Untold value to the fruit grower has been the result. Another thing that has been brought forcibly to my mind is that the average Missouri orchardist needs more demonstration work. Great results have come from what we have been able to do and if we can reach more of the fruit growers I am sure we may be able to do something with the San Jose scale.

Mr. Darsche—In how many counties have you found San Jose scale?

Prof. Taylor—My survey indicates about 25 counties are affected. It may mean only one orchard in a county and it may mean several. We have read about the spread of the scale in many places, but as near as we can find, about one-fifth of the counties are affected.

Mr. Miller—Not many years ago, at my home in Boonville, some fruit was brought in and was found to be infected. The orchard and surrounding orchards were examined and it was found that there was a great deal of scale in that neighborhood. A demonstration was arranged for and carried out, but the men did not seem to do anything about it. We need a State Inspector or some responsible person to see that the inspection work is carried out. There will always be some parties who will not spray even when the need of it is pointed out to them. In order to protect their neighbors and themselves the State should see that they do spray.

Mr. Darsche—The Missouri Valley Society passed a resolution that a State inspection law should be brought to the consideration of the next legislature. I believe such a law would be a good thing. So many people know that they should do a thing and never do it.

After explaining the law now in force, and some further discussion, a motion was made that the chairman of the meeting appoint a committee to draw up a bill to be presented to the legislature. Messrs. Todd, Hitt, Taylor and Stedman were appointed.

HOW TO CAN FRUITS AND VEGETABLES ON THE FARM.

(By Mabel Emerson Moore, Cabool, Missouri.)

BRIEF HISTORY OF THE CANNING AND PRESERVING INDUSTRY.

One of man's greatest problems has always been to provide the necessities of life. Therefore, the best methods of preserving fruits and vegetables for future use so as to retain as nearly as possible their natural color and flavor has been a constant study.

The beginning was by drying in the open air. Experience taught him that foods could be kept long and well when dried by the sun's rays or the heat of the fire, but still improvement was necessary, and in the year 1795, at the height of the reign of terror in France, the government of France offered 12,000 francs ($2,400) for the best method of preserving fruits and vegetables. This prize was awarded to M. Nicholas Appert in 1810, after he had furnished the government with a true copy of his methods of preserving foods in hermetically sealed packages. M. Appert was determined to work out the food problem, and devoted over fifty years to experiments before making known to the world his methods. He was a pickler, preserver and a maker of wines, and died at the age of ninety a poor man, having expended all of his earnings for the advancement of his work. While the honor is due him for the discovery of this great industry, yet we must note that there have been so many improvements that his book would be of little service to the practical canner of today, and is chiefly interesting as a bit of history.

Very little advancement was made until the year 1825, when Thos. Kensett, and his father-in-law, Ezra Daggett, obtained a patent which bears the signatures of the President of the United States, James Monroe, Secretary of State, John Quincy Adams, and the Attorney General, William Wirt, and its specifications mention canned goods in hermetically sealed cans. About the time the gold fever broke out the industry was just beginning to manifest its value, and it was about this time that tomatoes were first canned for commercial purposes. At the time Appert experimented with them they were known as "Love Apples."

NECESSITY FOR CANNING FRUITS AND VEGETABLES.

For the fruit grower to utilize that part of his crop which is unfit for marketing in the ordinary way is no small problem. It sometimes happens that weather conditions, disease, or insect pests, render a large part of a crop unsalable, profitably, as fresh fruit. More often, even when good fruit is produced, market conditions are unsatisfactory. There are many localities, especially in the Ozark region of Missouri, where fruit and truck may be raised easily, but where transportation facilities are limited, or lacking to such an extent as to render the growing of these crops out of the question. Formerly the only known methods of disposing of unmarketable fruit were evaporation and distilling, unless one were located near a canning factory, and canneries are usually limited to one or two kinds of articles in their output.

THE FARM CANNER.

To supply a great, long-felt want, what is known as the "farm canner" has been manufactured, and is being successfully used by hundreds of fruit growers and farmers all over the country. These small outfits were first made and used in the South, where they are now in quite general use. Texas has a "Home Canners' Association," which buys, cans, etc., in quantity, and sells the output of the various members through a single sales agent, with local branches throughout the state, and they have found the demand to exceed the supply by a large number of carloads. Since the National Pure Food Law became effective, there has been created a demand for a good quality of canned fruits and vegetables, which can be put up on any farm, and this manner of utilizing surplus or imperfect products has already become quite profitable, and promises to be still more so. The farm canner cannot compete with the factory as a source of great quantities of canned goods, but for quality it has every advantage, and it is in this line that it has its greatest possibilities. The large fruit grower, at a small outlay, can dispose of his surplus when the market is glutted, or his cull fruit when conditions are unfavorable for perfect development, at a profit nearly, if not quite, as great as he receives for the choice grade. The small fruit grower or ordinary farmer can, with a smaller outfit, dispose profitably of any surplus of fruit or vegetables he may raise, when otherwise these would be a total loss to him.

The truck grower frequently may can his product, and so market it more profitably than he can sell it fresh, at the height of the season. In a region where fruits and vegetables grow well, a farm canner will prove a most profitable investment. It requires no skilled labor, no experienced foreman, and the grower can realize double the profits of the larger factories. The work, while requiring careful, diligent attention, is light, and can be successfully carried on by women and girls, furnishing them profitable home employment, and possibly serving as an aid to the solution of the problem now so widely discussed, of how to keep the boys and girls on the farm. The outlay for the farm canner is small, and the machines are extremely simple, consisting, in the smaller ones for home use, of a boiler to be used on the kitchen range, with necessary attachments, crates and soldering outfit. However, a little larger machine, portable, with furnace, which may be set up in a shed, tent, or even in the shade of a tree, may be had for a little larger sum, and is far more satisfactory and comfortable to operate.

There are many makes of farm canners now on the market, but all are on the same general principle, the round machine with furnace being for several reasons conceded to be the best. These consist of a cast iron or steel firebox, with a process-vat, a drum-like iron reservoir with close fitting lid, above. Here the filled cans are exhausted and the sealed cans processed, or cooked, in the boiling water. The furnace and vat are enclosed in a sheet or galvanized iron jacket, and furnished with necessary pipes, valves, etc., and a hot air box. The firebox is furnished with holes to receive the coppers used for soldering, doing away with expensive special heaters, and being more safe as regards liability to cause fires from overturned charcoal or exploding gasoline. In the larger machines, a hoisting crane is used to raise and lower cans, and can be turned to deposit them wherever desired. This crane should have an automatic hoist, to hold the load at any desired height.

COST OF OUTFITS AND SUPPLIES.

The small machines for use on range may be had, complete at from $5 to $7. These usually have a capacity of five or six No. 3 cans at one loading, or eight to nine No. 2 cans. The machines with furnace range from $14 upward in price, with a loading capacity of eighteen to nineteen No. 3 and twenty-six to twenty-eight No. 2 cans for the smaller ones, the capacity increasing with the price. As good work can be done with the small machines as with the large, the difference being solely in the capacity and convenience of attachments.

The data submitted is secured from actual work done, not from theory or advertising circulars. The machine with a loading capacity of eighteen No. 3 cans will put out in a 10-hour day, about the following number of cans:

Tomatoes, 360 cans; peaches, 800; berries, 1,400; beans, 280, and corn, 56 cans.

The cooking process required for each fruit or vegetable ranges from five to eight minutes for berries to five hours for corn. When the labor of preparing the fruits and vegetables is considered, it will be seen that a large machine is not needed on the average farm.

The largest item of expenditure will be for the cans. These may be purchased for about the following prices, with transportation added:

No 1's, $11.00 per thousand; No. 2's, $15.00; No. 3's, $18.00, and No. 10's, $45.00.

Solder-hemmed caps cost from $1.25 to $1.50 per thousand. The quotations given are for the spring or early summer, as the price advances about $1.00 per thousand each month through the season. Cases run in K. D. from 8c. to 12c. each, and labels from $1.00 per thousand up. A well printed label can usually be had at about $2.00. A poor one is dear at any price.

PROFITS FROM CANNED FRUIT AND VEGETABLES.

The average yield of tomatoes per acre, under reasonably favorable conditions, is six tons, enough to fill 250 dozen No. 3 cans. The average wholesale price of canned tomatoes is 95c. per dozen. The profits per acre then might be estimated as follows:

250 dozen at 95c.	$237 50	$237 50
3000 cans at 3c.	90 00	
125 cases at 10c.	12 50	
3000 labels at $2.00	6 00	108 50
Net.		$129 00

A practical operator of a farm canner in Tennessee gives the following figures:

Cost of growing and picking tomatoes per doz. cans	$ .07
Cost of packing, per doz. cans	.06
Cost of cans, labels and cases per doz. cans	.36
Total cost per dozen cans	$ .49

The output sold at $1.80 per case, at a profit of 82 cents per case. The cost of cans, etc., is here rather below the average.

Figures submitted by the operator of a small outfit in the Ozarks are as follows for 100 pounds of tomatoes:

100 pounds of tomatoes at 35c.............	$ .35
Labels for 34 cans.........................	.10
Cost of 34 cans............................	.85
Total............................	$1.30

The selling price at retail with no cases was $2.50, thus leaving a profit of $1.25 per 100 pounds of tomatoes.

The average yield of an acre of peaches is 200 bushels. This quantity should fill 5,000 No. 3 cans, and the transaction should stand as follows:

5,000 No. 3 cans at 10c. wholesale.		$500 00
COST OF PACKING.		
5,000 No. 3 cans at 3c...........	$150 00	
Shipping cases for same.........	31 20	
Labels.......................	10 00	
Acid and solder...............	3 00	
Fuel..........................	2 00	
Labor.........................	18 00	214 20
Leaving a profit per acre of......		$286 80

The above figures are very conservative, the cost of all the supplies being extremely high. The labor also should be taken into consideration, as all the members of the family are employed, who have to be fed and clothed, whether they labor or not, while the larger factories are compelled to hire every ounce of their work done by disinterested and many times uncleanly and careless help gathered from the neighborhood.

The Louisiana Experiment Station gives the following interesting statement of canning experiments. In these experiments two No. 10 outfits were used, each having a capacity of 300 2-pound and 200 3-pound cans per day. With these two outfits the cost of canning the 600 2-pound cans of tomatoes daily was placed at $21.40. The net price for the canned product was 70c. per dozen, or $35.00, leaving a net balance of $37.93 per day.

The yield of any given article varies widely in different localities, but from the prices given on cans, labels, cases, etc., and the following table of number of cans per bushel, any one may figure his profit on his own average yield:

No. 3 cans,	apples,	20	per	bushel.
	peaches,	24	"	"
	pears,	30	"	"
	plums,	30	"	"
	tomatoes,	18	"	"
No. 2 cans,	stringbeans,	30	"	"
	blackberries,	50	"	"
	corn,	45	"	"
	peas.	16	"	"
	strawberries,	45	"	"

As to marketing these goods, the small grower can usually dispose of his output to local grocers, hotels, restaurants, etc. When larger quantities are put up, a market should be sought with retail grocers in larger towns within reasonable freighting distance, or with wholesale houses. It will probably not be long until the operators of these canners are organized in Missouri as in Texas, and dispose of their output through a sales agent. The only thing necessary to secure easy sale is *quality*. Have first class goods, for which there will always be a market. City dealers in fancy groceries, once shown these goods, will be glad to secure a steady supply.

DETAILS OF OPERATING A CANNER.

Every canning outfit must contain capping and tipping coppers and can tongs. A circle steel may be used, but is a convenience, not a necessity, as are crates, crane, etc. Have plenty of sal ammoniac and soldering fluid. The former may be had from any drug store, and the latter made by giving commercial muriatic acid all the zinc clipping it will dissolve. This may be diluted one-third to one-half with water. To put the coppers in working order, heat them well, rub in powdered sal ammoniac and a few drops of solder on a shovel or bright tin surface. This will tin the coppers nicely, and without it the solder will not flow. Have a memorandum tablet and pencil and a clock at hand, and record the time the cans go in and when they should come out. Never trust to memory for this, as it is a vital point, and there is much else to divert one's mind from it.

A large supply of *pure* water is an absolute necessity. Have also plenty of clean towels and clean white cloths for wiping the cans. A little experimenting will prove these, rightly used, superior to brushes. Have clean cloths for wiping the coppers. A long table or bench, of convenient height for soldering, will be required.

The cap is the cover of the can, and should be bought with solder rims. The capping copper is curved to fit the can, and is used for soldering it to the can. The tipping copper is the ordinary pointed affair, and is used to close the tiny hole in the cap after the exhaust. The tongs are used for lifting the hot cans. The circle steel is used for capping, but, as its name indicates, is made of steel and is a full circle, instead of a segment, as the capping copper.

"Capping" is merely soldering the cap onto the can. The groove into which the cap fits must be absolutely clean and dry and the contents of the can must not touch the top. Leave a space of one-fourth inch at least. Put the cap in place, and pass a brush, wet in the acid, around the groove, being careful not to use too much, as it requires but very little. Use a hardwood stick about like a lead pencil to hold the cap in place, putting the pointed end thereof in the center hole. Pass the hot, tinned copper slowly around the cap, and hold in place with the stick until the solder hardens.

"Tipping" is closing the hole in the cap after the exhaust. Wipe the top of the can, apply acid as before, and place the point of the heated tipping copper in the hole, and touch it with a piece of bar or wire solder, twisting the copper slightly as you take it out. The small triangular strips of solder are handiest and most economical to use. If these cannot be procured melt the large bars and pour into molds of pasteboard cut in strips 2½ to 3 inches wide and one foot long and bent at right angles to form a trough. This is far better than using the large bars.

To "exhaust," the can is capped and placed in the vat in clean boiling water, which covers up two-thirds of the length of the can. This allows the air to pass out of the little hole in the cap.

"Processing" simply means cooking or sterilizing the food in the can. The can is immersed completely in boiling water after tipping, and if any hole has been left in the soldering, it will immediately show by tiny air bubbles rising to the surface. Remove the can from the vat and remedy the defect. Sometimes one escapes you, and you will hear it whislte as it cools after being removed from the vat. When taken from the vat, the cans will be bulged out at both ends, if there are no leaks. When cool, the ends should be flat, as at first. Watch them, and see if any whistle or begin to bulge, and if they do, open the little vent hole, process again, and use at home, but never sell. When taken from the process vat, it is well to place the cans with cap downward. This helps to detect a leak before the can swells, and the contents are less liable to have become fermented.

"Blanching" means to boil quickly in water. This is done by putting the vegetables in a blanching basket, or even a clean, white cloth bag, and immersing it in boiling water for a given time. This eliminates certain acids and washes away the slimy product formed by bacteria, and frees and dissolves certain bitter substances. This should never be omitted when indicated in the formula. A clean washboiler on the kitchen range may be used for blanching where the machine used has no vat for that purpose.

The first vegetable for canning is asparagus. This is easily raised, and the canned product sells at a high price. The stalks are washed and placed in the can, which usually opens at the side, though the ordinary packer's can may be used, and the can filled with pure, cold water. Exhaust twelve minutes, and process 20 minutes.

Peas are hulled and blanched for 10 minutes, and be sure the water is boiling when you put them in. Pack solid in No. 2 cans to ½ inch of the top; fill with water, and cap. Be sure your peas are not too old, as they sweat and sour. Exhaust ten minutes; process sixty minutes.

For strawberries, blackberries and raspberries, hull and clean from trash. Avoid washing, unless absolutley necessary, as it detracts from the flavor. If handled with care, it is seldom necessary for cleanliness. Pack solid in two-pound cans, jarring them slightly to settle, but not mash. Fill with syrup or cold water, or place the required amount of sugar in the can before putting in the berries, and then fill to within ½ inch of the top with water. In this way the top is kept free from syrup, a drop of which in the cap groove renders soldering impossible. Exhaust four minutes; process eight minutes.

Cherries may be pitted or not, but as a machine for doing the work satisfactorily may be obtained for less than $1.00, it would be better to pit them. Pack in two-pound cans, in syrup, sugar and water, or clear water, as preferred. Exhaust seven minutes; process twelve minutes.

Grapes may be seeded by a little machine at small cost. Care must be taken to save the juice of this and all other fruits. Pick from stem, pack solid in three-pound cans. Fill with water. Exhaust seven minutes; process twelve minutes.

Peaches are peeled and cut in halves, if free. Clings are not pitted, unless sliced, in which case the pit is thrown out. Pack solid in three-pound cans, in syrup or water, according to grade. For the best grade, the fruit should be in unbroken halves. Pie peaches should have the fur removed by washing with a rough cloth, Turkish toweling being excellent, and are packed in either three or ten-pound cans. Exhaust five minutes; process fifteen minutes.

Apricots are put up in the same manner as peaches.

Pears are peeled, cut in halves or quarters, cored and packed solid in syrup or water. Exhaust five minutes; process thirty minutes.

Peaches and pears discolor so readily they must not be allowed to stand exposed to the air. The former should be placed at once in the cans; the latter, being more solid, may be placed in an earthen jar containing water, and this water used to fill the cans.

Plums—Seed and pack, then fill with water or syrup. Exhaust five minutes; process fifteen minutes.

Currants should be carefully cleaned, packed in two-pound cans and fill with water. Exhaust seven minutes; process ten minutes.

Apples are pared and cored. This may be done quite rapidly by any good paring machine. They are then quartered and packed solid in either three or ten-pound cans, in water. Exhaust five minutes; process fifteen minutes.

In the vegetables, string beans will follow peas. Those canned on the farm are a far different article from the tough, stringy, acid things usually labelled "string beans." With these, as with all vegetables, care must be taken to gather them at the right stage. Fruits may be a little over or under ripe, and it will hurt the quality less than a little age will in vegetables. Gather just when the bean begins to form. Throw out all imperfect or old ones, that have been overlooked in previous pickings, but pick these from the vine, as its bearing season will be shortened, if allowed to mature seed. A long, straight pod is preferable, as it is more easily prepared. The ends are cut off and the pod cut into pieces one or two inches long. Blanch ten minutes, pack in two-pound cans, fill with clear water. Exhaust ten minutes; process one hour.

Stowell's Evergreen is an excellent corn for canning. Gather when tender, but not too watery, and prepare as for the table, using a stiff brush to remove the silks. Slice off the kernels with a sharp knife, and scrape slightly to remove the core and milk, but not the hull. It must not be allowed to stand any longer than absolutely necessary between gathering and processing, as it sours more quickly than any other vegetable. Pack only to within one and one-half inches of the top, as corn swells somewhat in processing, in two-pound cans. Cover one inch with cold water. Exhaust ten minutes; process five hours.

The best variety of tomato for canning is probably the New Stone, though any medium sized, smooth, red variety, meaty, and with small core, is good. Handle with care in gathering and removing from field to canner. To peel, immerse in boiling water a moment or two—a process familiar to every one. Remove the skin first, and then the core, holding the stem side up during the latter operation, as less juice is lost that way. Pack as solid as possible, and, if necessary, use water to fill any cans lacking in juice. Exhaust eight minutes; process thirty minutes. Do not allow them to stand in process of canning.

Squash and pumpkin are treated alike. Peel, cook until nearly done, and pack solid. No water will be required. Exhaust ten minutes; process forty minutes.

Lima beans are shelled and packed in three-pound cans and filled with water. Exhaust ten minutes; process forty minutes.

Succotash is simply a mixture of corn and beans, and is quite profitable to can. Both should be young and tender. Pack in three-pound cans, not too full, and fill to within one-half inch of top with water. Exhaust ten minutes; process forty-five minutes.

Sweet potatoes are easily canned. Cook until nearly done, but yet firm; peel, and cut in halves or quarters; pack in three-pound cans, and fill with water. Exhaust ten minutes; process thirty minutes.

Prepare okra as for the table; blanch ten minutes in hot brine, pack in three-pound cans, and fill with water. Exhaust ten minutes; process thirty minutes. This may be canned with tomatoes as follows:

Blanch and chop fine, and add one-half in bulk to peeled tomatoes. Use what water is necessary, though little, if any, should be required. Exhaust ten minutes; process forty-five minutes.

Use beets about the size of a peach, or one and three-quarters inches in diameter. Clean very thoroughly, and trim off the top to within one-half inch of the beet. Cook until nearly done, and slip off the skin in cold water. Halve or quarter, if necessary, and pack in three-pound cans. Fill with water. Exhaust ten minutes; process thirty minutes.

Prepare kraut in the usual manner. Remove the kraut from the barrel, draining until there is but little juice, and fill in three-pound cans to within one-fourth inch of top. Cap and exhaust ten minutes; process sixty minutes.

A neat and attractive label should be procured for each article, as the outside appearance of the can must be in keeping with its contents. Do not put on the label until ready to pack in cases, as there is then no danger of their becoming soiled or rubbed.

To label cans, lay ten or twelve labels at a time, face down, on clean table, so that about one inch of the proper end of each is exposed. Brush this lightly with flour paste; place the can on the label, so that the cap will be at the bottom when the label is in place. Roll the can in the label and press down the pasted edge.

Given patience, care, perfect honesty in the quality of the goods packed, implicit following of sometimes tedious processes, and absolute neatness, and with a good make of canner, one can hardly make a failure.

GENERAL INFORMATION FOR COMMERCIAL HOME CANNERS.

Approximate cost of packing various fruits and vegetables when cash is paid for the produce, supplies and labor.

Kind of vegetables.	Size of cans.	Cost per case of 24 cans.
Asparagus	No. 3's	$3.50
String beans	No. 2's	1 00
Lima beans	No. 2's	1 30
Corn	No. 2's	1 30
Okra	No. 2's	1 60
Peas	No. 2's	1 50
Pumpkins	No. 3's	1 00
Squash	No. 3's	1 10
Succotash	No. 2's	1 20
Sweet potatoes	No. 3's	1 10
Tomatoes	No. 2's	90
Tomatoes	No. 3's	1 20

The following prices are about what packers pay for raw material delivered at the factory:

Apples	25 to 50 cents per bushel, according to quality
Apricots	$1.00 to $1.50 per bushel
Cherries	30 cents per gallon
Currants	30 cents per gallon

Gooseberries	30 cents per gallon
Grapes	$20.00 to $50.00 per ton
Nectarines	75 cents to $1.00 per bushel
Peaches	30 cents to $2.00 per bushel
Pears	40 cents to $1.25 per bushel
Pineapples	$6.00 to $9.00 per hundred pines
Plums	75 cents to $1.50 per bushel
Quince	40 cents to $1.00 per bushel
Raspberries	15 to 20 cents per gallon
Strawberries	2 to 6 cents per quart
Whortleberries	20 cents per gallon
Asparagus	$80.00 per thousand bunches
String beans	20 to 40 cents per bushel
Lima beans	75 cents to $1.00 per bushel
Corn	$5.00 to $6.00 per ton of 2,000 pounds
Okra	75 cents per 100 pounds
Peas	$1.00 to $1.25 per bushel, 1st pack; 50 cents to 75 cents, 2nd
Pumpkin	$5.00 per ton
Squash	$10.00 to $12.00 per ton
Sweet potatoes	$15.00 to $20.00 per ton
Tomatoes	20 cents to 45 cents per bushel
Tomatoes	20 cents to 45 cents per bushel, or $5.00 to $9.00 per ton

RELATIVE NUMBER OF PLANTS OR HILLS IN AN ACRE.

Giving the number in an acre when the direct and cross rows are of equal or unequal width:

Inches.	10 in.	12 in.	15 in.	18 in.	20 in.	2 ft.	2.5 ft.	3 ft.	3.5 ft.	4 ft.	4.5 ft.	5 ft.
10	62726											
12	52272	43560										
15	41817	34848	27878									
18	34848	29040	23232	19360								
20	31362	26136	20908	17424	15681							
24	26132	21780	17424	14520	13168	10890						
30	20908	17424	13939	11616	10454	8712	6969					
36	17424	14520	11616	9680	8712	7260	5808	4840				
42	14935	12446	9953	8297	7467	6223	4976	4148	3565			
48	13068	10890	8712	7260	6534	5445	4356	3630	3111	2722		
54	11616	9680	7744	6453	5308	4840	3960	3226	2767	2420	2151	
60	10454	8712	6969	5808	5227	4356	3484	2904	2489	2178	1956	1742

DISCUSSION.

Mr. Dutcher—I would like to know something about the home canning machine. Where did you get it?

Mr. Moore—We got our machine from the Home Canning Co., Bridgeport, Ala. They have several different sizes. We have been using a machine for five years which we paid ten dollars for. There are several different makes of machines.

Mr. Dutcher—What is the capacity of your machine?

Mr. Moore—That depends on the size of can used and the fruit or vegetable to be canned. Peaches require the shortest time and corn the longest. This is fully covered in the paper.

Mr. Holsinger—Mr. Moore said something about canning beans. I suppose he meant green beans. I should like to hear a little about varieties, methods, etc., of handling this crop.

Mr. Moore—Yes, the green bean was meant when I spoke of beans being canned. The variety we use is the Pencil Pod Wax, and we find it very satisfactory. While there may be other varieties that sell higher on the market, this variety is the best bearer, and we plan to can from it from June until the first of September. Be sure to keep the beans well tended to, and you will be surprised at the amount of beans produced from one planting. The beans are handled as described in the paper. You can, as you see, handle a good many cans in one day.

Mr. Todd—What is the capacity of your canner on beans per day.

Mr. Moore—360 two-pound cans per day.

Dr. Whitten—I should like to ask where it is possible to get any literature on home canning, the handling of different fruits and vegetables. I want to learn of something that is good home literature.

Mr. Moore—It is pretty hard to find literature on this subject. I do not know of any bulletin except the article my wife wrote some time ago for the Fruit Grower. This was afterwards published by the Kansas Experiment Station. This bulletin can, no doubt, be had by addressing the Kansas Experiment Station at Manhattan, Kan., which can, no doubt, supply you. I know of no other literature on the subject.

Mr. Stark—I should like to ask to what extent the Pure Food Law has been beneficial to the industry.

Mr. Moore—I don't know just how you mean. In what way?

Mr. Stark—Don't you find a better market for the home canned goods since the Pure Food Law went into effect?

Mr. Moore—I don't think the Pure Food Law has affected our sales very much. The supply always is far below the demand, so we have no trouble in disposing of our goods.

Mr. Schnabel—What experience have you had canning asparagus?

Mr. Moore—I have not had very much actual experience with this crop, very little in fact. But asparagus can be canned and canned easily. In fact, asparagus is one of the most profitable crops grown, as it is easily handled and quickly canned.

Mr. Stark—In reference to asparagus, I would say that at Council Bluffs a gentleman from Idaho passed around some asparagus which had been grown in the Snake River Valley. It was very fine, indeed, and I considered it superior to the French.

INTENSIVE FARMING.

Mr. J. M. Irvine made a short, interesting talk on the need of more intensive farming in Missouri as applied especially to orcharding. In this connection, he described the condition around Grand Junction and Palisade, Colorado. This latter place is a town only a few years old—about ten years—and they have graded, consolidated rural schools, good roads and splendid churches. They call their farms "ranches." These ranches are for the most part of small area. The people are content with small holdings well tilled. The average size of the ranch is less than 15 acres, but from these small tracts it is not unusual to see them clear more than the average Missouri farmer does on his 160. The secret of their success is in the fact that they are in love with their business of growing fruit and pay close attention to it. This has been one of the great troubles with Missouri fruit growers. They have large orchards which they are unable or will not care for. Then with so many, fruit growing is a side issue. They follow the business of general farming with more or less success, and if anything is grown in the orchard they are thankful for it but not to the extent that they will care for their trees. Mr. Irvine ventured the assertion that there is not to be found a ten-acre farm in Missouri which would more than give the owner a living, and a good income besides, if properly managed.

ORCHARD COVER CROPS.

(By W. P. Stark, President, Missouri State Board of Horticulture.)

Cover crops are highly essential to the present success of the orchard, but especially to its future success—the lack of it may explain failure.

The more we learn about the subject of cover crops, the more we appreciate its importance. Personally, we have had more or less experience in our plants in Missouri and other states. We have observed the cover crops used in the peach orchards of Georgia and other southern states, of the lake shore country of New York, of Michigan, Ohio, Maryland Delaware etc. and throughout our own State and particularly the cover crops—and too often the lack of them—in the West and Northwest. Ofttimes we hear the orchardists explain that we don't get the crops of the old times when this was a virgin country. To repeat such crops, one essential necessary is to put the soil in as near the fertile condition it was in following the removal of the forests. The mineral elements of the soil remain, but the humus has been "burned out." Too many orchards are starving, actually starving—and especially is this true of our Ozark regions. We have heard in these meetings, the advocation of weeds as a cover crop. Perchance weeds may be better than nothing, but is that good, up-to-date teaching? Orchardists interested will find in the bulletins of the Department of Agriculture, in various State Experiment bulletins, particularly Ohio, West Virginia, etc.—from which we are quoting generously—much valuable experience and information. The report of the Iowa State Society some years ago, gives valuable information concerning the hardiness and value of hairy vetch as a cover crop, particularly for such regions as are too cold for the growth of the Southern cow peas.

The average soil on chemical analysis shows a fair to a large amount of potash, phosphate, and other necessary elements. It is not a question of buying a car-load of fertilizer and wondering if it will pay. Commercial fertillizers may pay, and often do; and they are sometimes necessary when the soil has been worn out, but where soil contains the necessary minerals, and the air the necessary nitrogen, the question should be only one of making use of what you already have, by putting it into an available form, and not of buying a few tons of fertilizer. The nitrogen will be supplied by the leguminous crops from the atmosphere. The organic matter which is also added by these leguminous crops tends to make the mineral of the soil more available, and with proper management most soils will furnish all the necessary potash, phosphate, etc. A little green manure should be added every year, which will increase the nitrogen. This is the cheapest method, as it can be done by means of cover and catch crops at the end of the growing season when other crops have been removed.

Where any cover or manure is turned under, it forms humus, which makes the soil darker, and by test it has been shown that a dark soil is some degrees warmer than the same soil when lighter in color, when under the same conditions.

Humus in the soil makes it act like a sponge. It makes the soil more porous and able to hold more water and retain it longer. It makes a stiff clay soil of lighter tilth by separating and loosening the soil particles, rendering cultivation easier.

There are a number of bacteria working in the soil. They must all have food, and the beneficial ones are dependent, more or less, on humus and the decaying organic matter from which it is formed. When these bacteria work, or "digest" the humus, they set free carbon dioxide. The carbon dioxide is a gas which is taken up by the soil water. This solution is then able to dissolve many insoluble minerals from the soil which are necessary as plant food. Such substances as rock phosphate which are practically insoluble in pure water, are made soluble and available as plant food by the action of this carbon dioxide in water. It is this carbon dioxide in water that forms the lime-stone caves. Pure water alone can not dissolve lime-stone.

Humus is partially decomposed vegetable matter. It is not completely decayed. When the vegetable matter forms humus, or the humus breaks down to form still simpler compounds, heat is liberated. Whether a pile of leaves is burned or allowed to rot, the same amount of heat is given off in either case. This means the decaying organic matter in the soil makes it warmer and drier in the spring. Thus growth will start earlier and be faster throughout the entire season.

Speaking of some personal experiences with cover crops, my son and I have an orchard of about 200 acres, closely planted, at Rolla, Missouri—in the heart of the Ozark country. For six years we have made a study there of cover crops in a commercial way, and I have personally given considerable attention to it, and have kept in close touch with the experimental work done at the various stations. It is our opinion that to some extent the barren condition of the orchards is chiefly due to the improvished and starved condition of the soil, naturally deficient in humus. Therefore, our policy has been not to rob the soil, but to built it up for anticipated crops by adding to its strength, wherever possible, and by preventing any loss always having growing crops ready to take up food not required by the trees.

Bacteria working in the soil, especially during warm weather, are continually setting free food in the form of nitrates, and other minerals are also changing to a soluble form. The nitrates, unless used immediately, are liable to be lost by leaching away in the drainage water. There are some minerals also more or less soluble that may be lost by washing away in drainage water. However, their loss is not so great as that of nitrogen. To avoid this, a crop is necessary during the whole growing season. At the first of the season, the orchard while growing, can handle and use all of this available plant food. Later on, when the orchard growth is less active, it is necessary to have a cover crop of some sort to use this food and get it in a form that can be carried over until the next season without loss. Such crops as clover are especially good. They not only use all the available nitrogen in the soil, but they add more from the air, and in the spring they decay readily, liberating their contents to be used by the trees.

The ideal cultivation for orchards in the central West is, we believe, intensive, clean culture from early spring to June, then seed to cow peas—either drilling and cultivating or broad casting. In this connection, the Western Fruit Grower says:

"Regarding cover crops for the middle West, will say that we agree with you that nothing is better than cowpeas, except that lots of orchards are on hills so steep that it will not do to give them cultivation in early spring, during the rainy season. We think that very soon we shall have to adopt a plan of cultivating two rows and leaving the next two rows in clover, and alternating this treatment."

There are numerous and various varieties of cowpeas adapted to the different orchard regions. Occasionally, we have followed a crop of cowpeas with a crop of corn. During the last cultivation of the corn more peas are sown, or hairy vetch. The vetch supplies a fine crop for plowing under in the spring. Vetch also becomes a profitable pasturage crop for hogs, when their age and size will permit pasturing them without injury to young trees. On this subject of hairy vetch, Agrostologist F. Lamson-Scribner in 1895 reported:

"Hairy vetch sown in autumn will cover the ground and prevent washing during the winter. It is one of the best crops to turn under as green manure. Do not commence to feed hairy vetches until they have begun to blossom. Like most of the bean and clover family they are somewhat diuretic if fed in large quantities before mature. Use caution in feeding until the animals have become accustomed to the change of food."

Peas may be utilized in the same way—just as you would clover. We have occasionally used a crop of red clover, but its use is too familiar to need further comment here. We have also used alsike clover which in some cases is better than red clover.

Some sort of cover crop throughout the winter not only prevents washing, which is so disastrous, but holds the winter snows, and lessens the depth of alternate freezing and thawing. Also, in gathering the crop in the fall, it makes picking and hauling of fruit a much cheaper, easier, and cleaner job.

The rapid growth induced by cultivation through the first of the season is inclined to make the new wood of the trees soft and tender. To check this growth and harden the wood for winter, a cover crop is necessary. The weeds or volunteer grasses might be allowed to fulfil the same purpose, but they do not add the same amount of fiber to the soil, and they certainly add absolutely nothing in the way of nitrogen from the air.

During the last several years, I have traveled over considerable country, particularly the Ozark regions of Missouri and Arkansas, and I may be pardoned for stating that the strongest, healthiest, most vigorous growth I saw on these trips was in this Rolla orchard thus cultivated. And I believe that a generous use of cover crops in orchards throughout the State, particularly on the thinner soils, the value of the crops may be continually increased. Also the life and productive age of the orchard materially increased.

Rye has been used to a limited extent, but it has not been so successful a crop in the Rolla country as peas, vetch and clover. When the trees are getting too much nitrogen, the growth is rank and succulent; cover crops are just as necessary, but rye or some other non-leguminous crop should be used. It gives humus and protection without adding more nitrogen, and also serves as a check which helps the formation of fruit buds. Quoting from a bulletin on the subject:

"While in general the use of a cover crop in cultivated orchards is advantageous, there are cases where, if used injudiciously, it may be actually detrimental. One such case is the use of rye upon a soil naturally dry and gravelly; especially if the crop be left late in the spring before plowing under. This treatment may result in so drying the soil as to seriously interfere with the growth of the trees. On soils of the nature indicated, one of the vetches, oats or clover is to be preferred; particularly if the land is not to be plowed promptly in the spring."

The growing of Spanish peanuts in young orchards is worthy of a trial. We have also used velvet beans which we believe are adapted to conditions further South where the season is longer and will mature the crop.

During the past season, in company with Mr. Irvine, editor of the Fruit Grower, I visited the orchard regions of Colorado, Utah, Idaho, Oregon, Washington, and Montana. We made it a point to inquire about the cover crops. Generally our Western friends—and we may add that the most successful ones are generally from Missouri—all admitted that they knew but little about them, but felt their need, although some had had some little experience with clover. Their soil, which is rich in minerals, is often deficient in humus. This is one of the greatest problems they have to solve, and is one to which they should give far more attention.

There are many forms of mineral plant food in the soil which are not available to many of our cultivated plants. Even under the best conditions they have not the power to use them. On the other hand, certain of our cover crops can digest these less available foods, and when they decay, leave them in the form convenient for other weaker plants.

Many plants can not work below the surface layer of the soil; that is, they can not go down into the sub-soil. Sub-soil contains a large amount of material, in fact, the surface layer is merely a subsoil to which humus has been added by the growing plants. This sub-soil is very rich in the necessary elements, and it is the clovers and other cover crops which send down their roots into this subsoil and bring to the surface foods which other plants can not reach. They not only bring these foods to the surface, but the roots remain down there and decay. Eventually the sub-soil is incorporated with the surface soil, or in other words, the surface soil is made deeper by these roots working around in the sub-soil, loosening it up and adding humus to it.

The higher elevations are not adapted to the growth of cowpeas, but doubtless our plant breeders will give us hardier strains and varieties adapted to every condition. Clover can be used advantageously, but perhaps it is not the ideal crop for those localities where intensive cultivation is practiced. The hairy vetch is probably one of the very best crops suited to such method. Intensive clean culture can be given until mid-summer, then sowing vetch and turning it under the following spring. We have found Canadian peas a most desirable cover crop in the Genesee Valley of New York. These peas are also utilized very largely in New Mexico. This is a great crop for the fattening of lambs and hogs, and here is a suggestion that may be of some value to the West, grow these peas as a crop for the fattening of sheep and hogs, thereby manufacturing at home a most valuable brand of fertilizer which is one of the most effective methods of supplying the humus required by Western soils.

While in the West we noticed a few orchards sown in clover and for partial cultivation they plowed a strip and left a strip. The strip left standing thus became a seeder for the strip turned under, and so caused fairly good cultivation.

Captain Shawhan, a grand old man of Payette, Idaho, the products of whose orchards attracted most favorable attention and some blue ribbons at the Council Bluffs Apple Show, and also at the Spokane Apple Show—believes in cover crops, and the adding of humus to the soil, thus feeding his trees. He says when he takes such wondrous crops of fruit from his trees that he feels duty bound to give them something in return. Therefore, in addition to cover crops he makes generous application of barn-yard manure, and the soil is so porous and loose that in walking through the orchard one sinks to his shoe tops. Our Mr. Todd will also remember with pleasure his visit to the orchard of Capt. Shawhan where the orchards were so laden with crops that the orchard middles almost resembled the poles in a hop field. We believe that Capt. Shawhan has come nearer to solving this problem than any other orchardist of the Far West. His location is one peculiarly adapted to red clover and one of the most beautiful sights of our entire trip was the magnificent red clover fields in the Twin Falls country in the Snake River Valley, yielding, we were told, from $80 to $110 worth of seed per acre. Seemingly, that is a country that should be devoted to producing the ideal clover seed for the clover world.

In planting a later addition to the Rolla orchard, consisting of 15,000 trees, mostly one-year but with some two-year, we applied to each tree several pounds of commercial 583 and bone meal. Every tree lived, not *one* failed to grow and all made a most vigorous growth. Planters of western orchards on land deficient in humus have supplied the deficiency by this method rather than lose a year's time in the cultivation of some crop. We suggest that each tree be given, at the time of planting, several pounds of sheep or other manure, or some commercial brand of fertilizer as may be convenient. Abundant humus may then be supplied by the cover crop to follow. This method is also suggested for old lands lacking in fertility. The money and time spent in applying a stimulant will prove a profitable investment.

THE STRAWBERRY, AS GROWN COMMERCIALLY IN THE WEST.

(By J. H. Christian, Neosho, Mo., Member of the Missouri State Board of Horticulture.)

(Note: Mr. Christian is an authority on many phases of the strawberry business, but is particularly well posted on shipping associations. The well-known Neosho Association was largely created by him, and for many years he has been its manager. He was sent by the Board of Horticulture to study conditions, methods, etc., in the West.—*Secretary.*)

In looking over the strawberry fields in far west, the thing that impresses one the most, is the care and labor the growers give to the cultivation of the plants—the intensive cultivation that is in evidence everywhere. The soil is kept mellow and absolutely free from weeds and grass. By keeping the ground in this condition, the berry plants are given a chance to do their best work in producing perfect fruit, and results have shown that the strawberry plant, when so treated, has not disappointed the grower.

In the district around Hood River, Oregon—and I speak of Hood River because the growers there have an enviable reputation for fine fruits, and an honest pack, and it is well to study the methods of those who are making a success of the business, that we may profit by their experience—the growers are raising strawberries on land valued at $1,000 to $2,500 an acre. They pay for irrigation privileges, and during the busy season of cultivation they pay as high as $3.00 per day for hired help in plowing, hoeing, etc., and yet, on this high-priced land, and with these heavy expenses, they are making a success of the business, financially. The care they give to their berry fields enables the plants to produce fancy berries that have established a reputation in the market, which makes them in demand at top prices.

The Hood River growers have found that the Clark's Seedling strawberry grows to perfection in that locality, and they are growing that berry almost exclusively. They set the plants in rows, 30 inches apart, and place the plants 15 inches apart in the row. This gives them 13,939 plants to the acre. All runners are kept cut off as fast as they form, and by this means they force the original plant to grow a number of crowns in a cluster around itself, and each of these crowns puts out fruit stems. By this way of treating the plant, instead of having a wide row set with plants, as they would if the runners were allowed to grow, they have a cluster of fruit-bearing crowns, occupying a small space. This

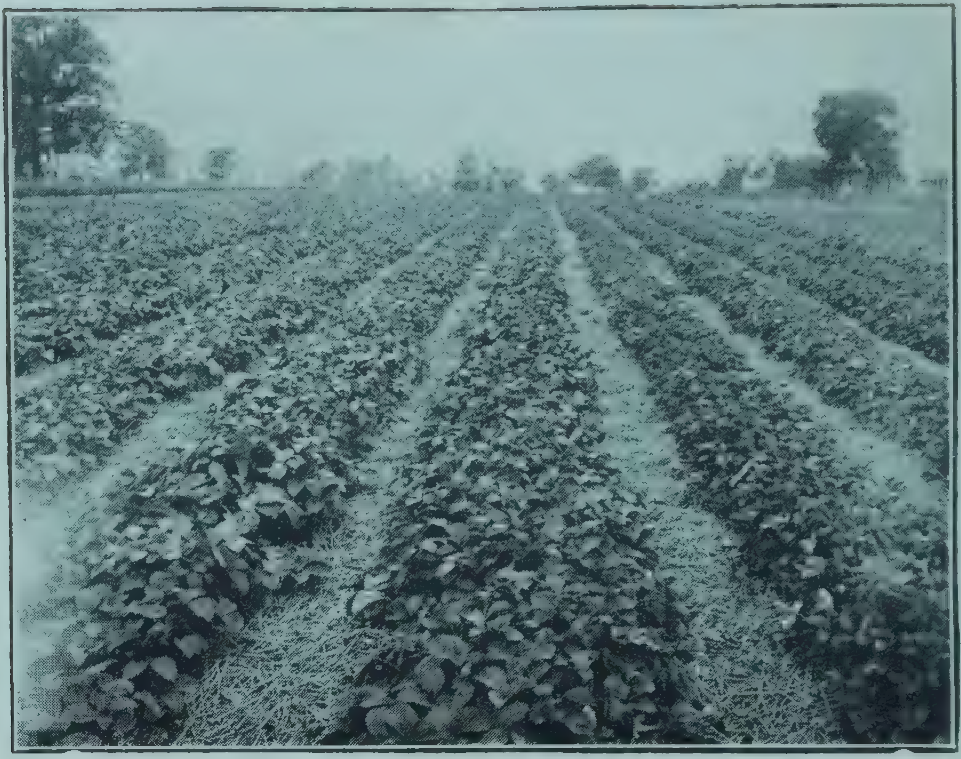
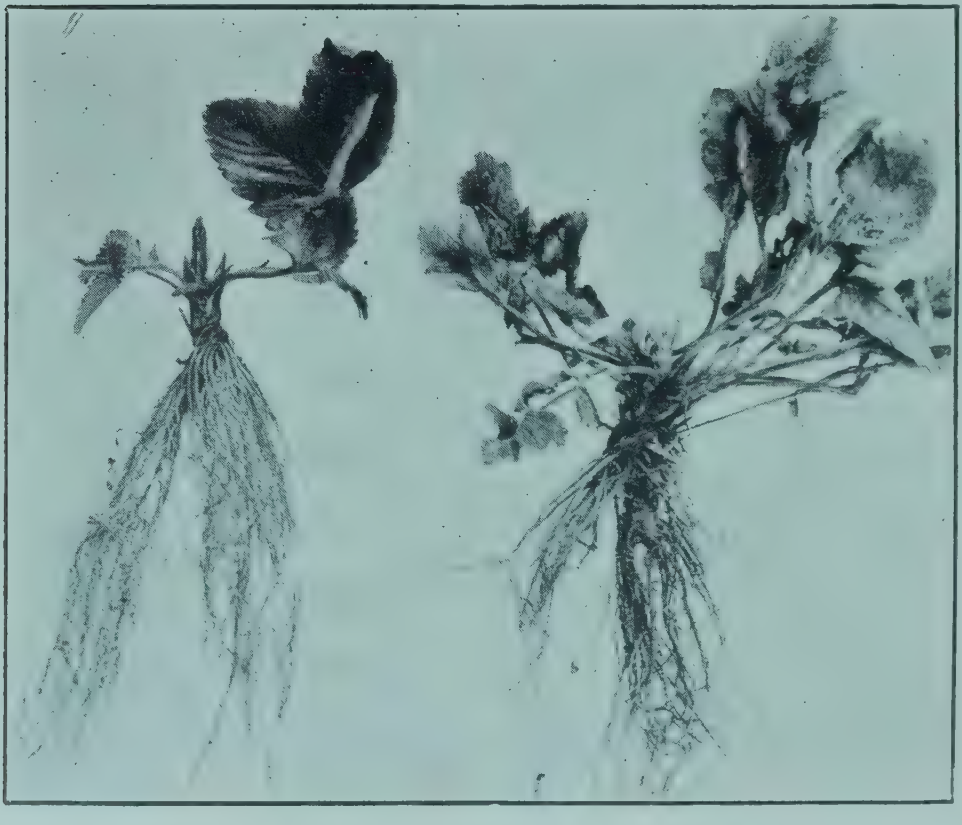


Figure 1. Strawberries grown by the matted row system, the common one in Missouri. In the northern half of the State it is necessary to protect plants in winter by covering 4 or 5 inches deep with clean straw, which is slightly raked away in spring to allow the plants to get through.



No. 1. No. 2.

Figure 2. In setting strawberry plants, only plants of one season's growth should be used. See No. 1. No. 2 is an old plant with a long, hard, woody crown and black roots. Young plants like No. 1 have white roots.

method of growing the plants makes it easier to cultivate the ground than when grown in the matted row. I was told by one grower that his plants, grown in this way, had produced an average of two hundred 24-quart crates of strawberries per acre for seven years. Other growers with whom I talked claimed that the berries grown in this way were larger and finer than when grown in the matted row.

The berry growers of Hood River have formed an association known as the "Hood River Fruit Growers' Union," for the purpose of mutual assistance in handling and marketing their crops, and securing a uniform grade and pack of fruit. Their aim is to make the name of their association, when stamped on a crate of their strawberries, mean something to the purchaser, and it does. Their stamp is a guarantee that the fruit is honestly packed, and the consumer soon learns this and he doesn't forget it from one season to another. By their care in grading and packing fancy stuff, the fruit and berry growers of Hood River (a little town of 2,500 to 3,000 people) have made the name of Hood River a familiar one all over this country, and it is for that reason better known to the fruit merchants in Europe, Japan, China, and the Philippine Islands, than the names of many of our large cities. The growers take a lively interest in their work—their enthusiasm is contagious, and every man, woman and child is a "booster." They keep Hood River and its advantages before the people all the time.

I was told that an apple grower from New York, who was visiting Hood River for the first time, asked the landlord of the hotel where he was stopping, how far it was out to Portland, and when told it was seventy miles, he seemed much surprised, and remarked that he had thought all the time that Portland was a suburb of Hood River.

But Hood River and the other berry growing districts of the west are not the only places where fancy strawberries are produced. Strawberry growing in Missouri is an important industry. We grow strawberries that cannot be excelled anywhere for size, quality and firmness. I should like very much to be able to give the figures showing the amounts realized by the berry growers all over the State for the last few years, but I have only been able to secure the official figures from a few associations, all of which are located in Southwest Missouri. From the strawberry crop of the year 1904, the growers in nine associations realized $186,501.19. The crop of 1905 brought the growers in twenty-two associations, $250,440.77; the crop of 1906, seventeen associations,

$331,162.21; 1907, nineteen associations, $380,900.29; and the crop of 1908, $243,991.91. The strawberry crop of 1908 was badly damaged by late frosts—it was cut short 50 per cent or more in many places, but for the five years given, the growers belonging to the associations mentioned above, have received a total of $1,398,996.37, for their strawberries. As Business Manager and Treasurer of our home association at Neosho, I have paid to our strawberry growers $148,597.68 as the proceeds from the sale of their berries for the years 1907 and 1908, both of which years the apple and peach crops have been knocked out by late frosts in our locality.

I have been growing strawberries continually for the last fifteen years (where I live) and have never yet had a complete crop failure from any cause. In seasons like the last two have been, when strawberry plants and the apple and peach trees are all in bloom, a late frost knocks out the apple and peach and they lay down and quit for the season. Not so with the strawberry plant. It gets a black eye, but doesn't give up the battle. It immediately gets busy with the work of producing more bloom and will come out with at least part of a crop. I think that strawberry growing can be made more profitable in Missouri than it is in the far west if our growers will make a study of it as they do there and give their plants the same thorough cultivation and care. When properly handled, our soil can be made to produce two to three hundred crates of fine berries to the acre instead of a hundred crates or less, as it is now with many of our growers. Our lands are cheaper, labor is cheaper, there is no expense for irrigation, and we are nearer to markets than the far western berry growers, and with proper care in growing and packing, we can poduce strawberries that will successfully compete with berries grown anywhere. We are doing that now. There are great possibilities ahead of Missouri berry growers—let us grasp them and make them realities. We should find out, by testing them, what one or more varieties grow to perfection in each particular locality, then plant the varieties proving best results and discard all others.

There is no one variety of strawberry plant that will do its best in all localities. For instance, at Logan, Mo., they grow Gandy, which can't be beaten anywhere. It is a money-maker for the growers, and yet at Neosho, my home town, only 48 miles from Logan, we tested the Gandy strawberry several years ago and had to discard it because it "buttoned" so badly. We would lose from one-half to two-thirds of the crop on that account. Clark's Seedling, the strawberry that is grown so successfully around Hood River, Oregon, and where grown, is one of the firmest, best shipping berries grown anywhere, is a failure with us, so far as shipping qualities are concerned. It makes a fair table berry, but is too soft to carry in shipping to distant markets.

We have found, in the locality where I live, that the Aroma seems to be entirely at home, and when properly cared for grows to perfection, and for this reason we have grown the Aroma almost exclusively for several years. It would be largely to the interest of every strawberry association in Missouri, if they haven't already done so, to find out what varieties are best adapted to each locality, and then grow the ones that promise best results. I think many of us would find it profitable to cut down our acreage and put more labor on what is left. It doesn't matter how large one's berry field is so long as it is given thorough cultivation and proper care, but I think many of us plant a larger acreage than we can care for as we should. We would find it more profitable to grow fewer acres of fancy berries that would sell for good prices, than to grow a larger acreage that, for want of proper cultivation, would produce medium or inferior fruit. It does not pay to raise the latter at all.

Every now and then we are haunted with the fear that the strawberry business is being overdone, that we are growing more berries than the demand justifies. I heard the same talk in Illinois twenty-five years ago, but the berry acreage has been increasing ever since then, and still there is a market for them, and there will continue to be, for the increase in population makes the demand for fruit greater each season. If we are going to neglect our plants after setting them, if we fail to take care of them so that they become foul with grass and weeds and produce only inferior berries, we are overdoing the thing, no matter how few we plant; but if, by the proper work and care, we grow large, fine, berries, we need have no fear. There will always be a market for strictly fancy strawberries at fair prices. Even at times when the market may be glutted with the inferior kind, there is a class of people in all markets who have the money to buy what they want, and are ready to pay for something that is fancy. That is the trade for the up-to-date strawberry association to cater to. Grow fancy berries and pack them honestly. The man who has the money to pay a good price for something fancy expects to get something extra nice. He has a right to expect it. If we have strictly fancy berries, let us take pride in branding the crates "Fancy." If they are choice, mark them so, but if they are only medium, or badly mixed, it is better to leave the marks off and let the berries sell on their merits and save our reputation for honesty. We cannot change the grade or quality of a crate of poor berries by stamping it "Fancy" or "Choice," neither can we deceive the consumer by doing so, and we will only injure our business when we do it.

It will pay us to direct our best efforts to the raising of fancy berries, and in order to do that we must begin by preparing the soil properly for the plants, set out strong, vigorous plants, and then follow that up by clean and thorough cultivation throughout the growing season. Give the plants every possible chance to do their best work in growing and maturing a strong root system as a foundation for a large crop of fine fruit. There is no plant I think, that responds more liberally to good treatment than the strawberry.

I might talk here of the best way to cultivate the strawberry, but to discuss that fully would add too much to the length of this paper. All of us know, in a general way, how to grow fine onions, celery, beets, cabbage, etc., as it is done by keeping the soil fertile, thoroughly worked, mellow and free from weeds and grass. Just treat the strawberry plant the same way. It takes lots of labor to give this kind of treatment to a large field of berry plants, but it pays to do it, and the man who is afraid or unwilling to go to the expense of proper cultivation had better try something else, for he will be disappointed with results if he neglects to do it.

Now a word as to the hill culutre of strawberries as practiced in the far west. The late Mr. Kellogg, of Three Rivers, Mich., who was a successful grower of berries and berry plants, advocated the hill culture method of growing berries as the most profitable and satisfactory way. In view of the success of the far western growers who use this method, it would be well for us to test this plan in a small way until we see whether we want it, and if it prove a better and more profitable way than the matted row, we should adopt it. Many of us would find it profitable to give more attention to keeping our soil in the best condition. To produce the largest crops of fine berries out west, they let the berry plants produce two or three crops of fruit, then plow under and sow the ground to red clover or cow peas for a year or two, then turn that under and set to strawberry plants again.

It will be greatly to our interests as strawberry growers to study all these things in conection with our business, and by learning and adopting the best methods, we will add largely to the profits and pleasures of it.

I want to speak now of something outside of the growing of strawberries, but something that is of vital importance to the berry growers. That is the refrigeration of the fruit while in transit, from the time it leaves the hands of the grower until it reaches the market. After we have given the best of cultivation, gathered the fancy fruit as a result of our work, packed it in neat, attractive crates and loaded it into the car ready for shipment, then comes the problem of perfect refrigeration so that the fruit may reach its destination in prime condition. The refrigerator car, when set in the shipping shed to be loaded, has been previously iced, so as to be cooled by the time we are ready to begin loading the berries into it. When we open the car to begin loading, it may be cold inside, but by the time we have loaded into it five or six hundred crates of very warm berries with half a dozen loaders doing the stripping and bracing, the heat from the lights that are necessary to be used inside the car so the nailers can see to work, when the car is loaded ready to be closed, the upper half is filled with warm air arising from the heated berries, and on stepping inside, one meets a varied assortment of odors, prominent among them the smell of the berries, the new crates and boxes, the varnish inside the car, and so on, a collection of poisonous gases, that must be very detrimental to the carrying qualities of the berries. An experience of five years in superintending the loading of strawberries has demonstrated that berries picked during a cool day that has been preceded by a cool night, will carry better than those picked during very hot weather; also, that berries loaded at a time when there is a good breeze blowing, one that will carry off some of the heat and gases from the crates while they are on the platform waiting to be loaded into the car, and will at the same time drive much of the foul air out of the car as it is being loaded, carry better than when loaded during a time when no air is stirring.

The cantaloupe growers out west have been experimenting recently with a pre-cooling process, that I believe promises wonderful possibilities for the strawberry business. It is very simple, and solves the problem of getting rid of the poisonous air in the cars, and at the same time cooling the fruit before it leaves the loading shed. It is done by using a suction fan and a section of hose. After loading the car it is closed, except for a space large enough to insert the hose over the door, and the fan is set to going, sucking the warm, foul air from the car through the hose and discharging it outside, at the same time reducing the temperature in the car to any degree desired, leaving the contents thoroughly cooled and surrounded by pure air. I was told that it took but a comparatively short time to do this, and ripe cantaloupes treated in this way have remained in the car for fifteen days and arrived at their destination in fine condition. If this is true, there is no reason why strawberries should not be made to carry six or eight days or even more, by the same means. A plant for pre-cooling our berries would cost but a few hundred dollars at most—I don't know how much—but we sometimes lose several hundred dollars during one season on account of imperfect refrigeration. It is worth while for us to consider this matter and experiment along these lines.

The average strawberry grower is not in the business for his health, it is too strenuous for that. What we want is cash results and if we are to secure them, we must keep abreast of the times by studying the best methods, adopting them and improving on them. If each strawberry grower in Missouri would commence now, give his plants thorough cultivation, select the varieties best adapted to his locality, raise the finest fruit possible and look carefully to the proper packing of it, the increased profits from this kind of culture would double the value of his land in five years.

DISCUSSION.

Major Holsinger—Why do berries button?

Mr. Christian—That is something we have puzzled over a great deal. I must confess, however, that I do not know. The Gandy is one of the largest and finest berries grown. I had seen the Gandy in Illinois. I got hold of a few plants and planted it. The first year I put out one-half acre. They grew nicely and I had a fine crop and I sold the whole crop at an advance of 75 cents a crate over the other berries in our locality. I thought I had a bonanza. I put out a lot more and passed the word around to my friends. Five or six of us put out a large acreage. We had a little frost late that year and nearly all the berries buttoned. I have tried them on all kinds of soil and find the buttoned berry on all of them if it is on one. In an average season they do well, but a certain per cent of the berries button every year.

Mr. Taylor—Have you had any experience with the tarnished plant bug? Buttoning is attributed to this bug sometimes.

Mr. Christian—No, we have not had any experience with any insect pest. I am looking for it but so far we have not had to spray.

Mr. Taylor—You used to have trouble with the tarnished plant bug in your state, did you not, Mr. Culp?

Mr. Culp, of Illinois—Yes, but I am not familiar with it.

Mr. Holsinger—I feel like Mr. Christian about this question of buttoning, I do not know what does it. We attributed it to dry weather, or to conditions arising from dry weather. But we have had the same experience with other varieties. The Gandy has done well only once for us. I would not plant it commercially, but I would plant the Aroma almost exclusively. We had the Gandy every year and only one year did we make money out of them. The other years we were troubled with buttoned berries. That was in 1901. We guessed it would be a dry season. We had five or six acres that year, but were able to water only about three or four of them. We made more clear money out of strawberries then than we ever made before. Those not irrigated buttoned. Those which were irrigated, did not.

Major Holsinger—The unirrigated berries were absolutely worthless. In a small way I have tried irrigating several times and have never been troubled with buttoning. I claim it can be controlled by water supply, and that buttoning is only nature's way of regulating the size of the berry, or the number of offspring as measured by the seed, to the food or water supply.

Mr. Christain—I am glad that the Major gave us his experience, but I am sorry to say that in our soil, we cannot irrigate.

Major Holsinger—We had a very crude plan of irrigation. It was simply an engine which pumped the water from the river into the laterals.

Mr. Christian—We cannot irrigate in the Ozarks on account of the nature of the soil. It is too porous. We might be able to get the water, but after a rain in the hills the flint rocks show. We must keep our soil and not take any chances of losing it by flooding the ground.

One thing about the Aroma berry which we appreciate so much, is the fact that it is easily picked. Fifty persons can pick ten acres if we have a long steady season. But if the season is erratic and the cold weather holds up ripening and then we have a large number of berries maturing in a few days, or if we have some rainy weather, then the picking becomes a big problem. Fifty persons cannot then keep it picked up good. But with the Aroma, we can allow it to remain on the vines for a time after it will do to pick, and it still will ship in a firm condition. This is a big item in the strawberry business.

Major Holsinger—What do you think of the hill system as you saw it out west?

Mr. Christain—I am not hardly prepared to tell you which is the best system, but the hill system undoubtedly has many good points, and I intend to give it a thorough trial. I am putting out a small number of plants myself to experiment with. There is no doubt but that the berries can be picked more easily and better. They can be cultivated better and more cleanly, but whether they will give better results in Missouri, in our sandy soil of South Missouri, I am not prepared to say.

Mr. White—Have you any moles?

Mr. Christian—Yes, some; not enough to make any trouble. Where we cultivate thoroughly we are never bothered with moles.

Mr. Rogers—Have you tried the hill system in a commercial way?

Mr. Christian—Not yet, I am sorry we have not. I am inclined to believe it is a pretty good thing. But I would advise not to put out too many to start with. We do not have to mulch. It would be a good thing on that account.

Mr. Irvine—I would like to have Mr. Christian describe the runner cutter which the growers use in cultivating the plants under the hill system.

Mr. Christian—It is a good deal like an old post hole digger. Probably it can be better described by saying it is similar to a stove pipe 18 inches long. However, it is usually made of a little heavier metal than a stovepipe. In the rocks in south Missouri we would have it of heavier metal. Also it may be larger than six inches in diameter, depending upon the size of the hills.

Mr. Irvine—In regard to the Hood River country, I do not think that the Missouri growers have anything to fear. There is no doubt but that Hood River can grow good strawberries, they have good associations and can market the berries profitably, but they cannot grow them with such quality as Missouri can. The Clark Seedling has not the quality that our Aroma and other berries have. They are not growing the berries there that we can here. They are not "in it" when it comes to making money in strawberries. We are nearer to market, we can raise better berries, we can raise them cheaper and sell them at better prices.

Mrs. Cox—I should like to know more about hill culture. I have two or three vacant lots in St. Joe and should like to get them in cultivation to produce something and had thought of strawberries. Would I have a right to expect a larger yield from hill culture than from the beds.

Mr. Christian—It is probable that you could get better results from hill culture since you can give the plants planted in this way more intensive cultivation. In regard to the method of hill culture, in order to give definite directions to the lady asking the question, will say that the plants are set out in rows 30 inches apart and placed 15 inches apart in rows. The runners sent out by the plant are cut back, causing the original plant to grow a number of fruit crowns from which the berries will come. The plants therefore form a hill, hence the name of hillculture.

Mr. Royer—About buttoning of strawberries—I thought I was certain about the cause of this trouble, but I see now that I may be mistaken. I was under the impression that it was due to the lack of pollination of the strawberry. I would like to know from Major Holsinger or other grower, what his experience has been in this line?

Major Holsinger—I am not in sympathy with this view of pollination since I made my experiment. The buttoning of the berries is, so far as I am able to judge, a lack of moisture at the proper time. If it were pollination, tell me why the berries were good? When the boys began to pump the water there were crawfish holes everywhere—the ground was in the river bottom near the stream, and in three days after the watering had begun, they estimated they had saved the price of the plant.

Mr. Royer—Was there any water applied before the period of blooming?

Major Holsinger—No.

Mr. Irvine—I should think that anything preventing the growth of the plant or the berry would have a tendency to cause the button. Buttoning is stunted development. I am under the impression that the lack of moisture or of plant food would have a tendency to cause this.

Major Holsinger—I think this is true, and I was simply giving you my experience with buttoning and irrigation. I should like to ask if the Brandywine is a berry that buttons badly.

Mr. Christian—I have only grown the Brandywine in a small way, mostly for home use. It is a splendid berry, but must be picked at the right time or it grows mushy and will not ship. I did not notice that it had a tendency to button badly. I should say that the Brandywine is a splendid berry for home use.

Mr. Hitt—Our experience was that the Brandywine was a splendid berry in the Koshkonong district.

GROWING CANTALOUPES IN COLORADO AS SEEN BY A MISSOURIAN.

(By L. C. Wilson, South St. Joseph, Mo., Member of Missouri State Board of Horticulture.)

Rocky Ford has been the most successful of all localities in the United States in the growing of cantaloupes. Why this is true the writer does not feel able to answer, but he will try to give some reasons: First, the soil seems to be especially adapted to the demands of this crop, being uniform in fertility; also, the climate being usually very dry, irrigation is necessary, hence moisture can be supplied when needed.

All practical growers from regions of more rainfall, at once see the great advantages of the above conditions, for the following reasons: Every rain in spring, while plants are small, except it be a very light and warm one, checks the growth of plants. The heavier and colder the rainfall is the more damage follows. The damage does not come so much from the moisture in the ground as from the earth being washed up on the plants in some cases, while in others the earth is washed away from the roots. Sometimes in very heavy rains the plants are so maimed that it requires several days of favorable weather before they resume their normal growth.

Later on, at the time melons are setting, while they are still covered with tomentum (fuzz), the heavy rains wash the earth upon them, and, lodging there, cause nearly the whole setting to wither and fall from the vines. These facts are mentioned in partial explanation of why "Rocky Ford" melon growers have been successful.

The methods of planting are not different from those employed in other regions, and neither is the cultivation. I might mention here that it is very detrimental to all such vines to cultivate deeply near the plants. Remove the weeds by hoeing just deeply enough to kill them, then draw some loose soil up around the plants from a distance sufficient not to disturb the roots.

The matter of seeds is one that seems to be ever in the mind of the Rocky Ford melon grower. He will talk to you more and oftener on this subject than any other. He cuts his seed from the most perfect melons to be found in his field, and he also keeps in mind the individuality of the plant, both as to its hardiness and productiveness. This vigilance has resulted in originating a strain known as the Pollock, which is in a great measure immune to blight or rust. Every cantaloupe grower knows the importance of immunity from this dreaded disease.

There are two other strains grown at Rocky Ford—the Waters and Burrell's Gem. Waters is about ten days earlier than either of the others, and sometimes is badly damaged by blight, but on account of its earliness, most growers plant part of their crop of this strain. The Pollock seems to be very nearly the same as the Waters, except it is not immune to the disease mentioned.

Burrell's Gem is more like a distinct variety than a strain of the other two, in that it is not so heavily netted and that its meat is a golden-yellow; however, it is a melon of very high quality.

Let us now take up the question of seed. I had never thought that cantaloupe seed could be cut from a high grade of melons, pass through the hands of the jobbers and retailers, and be sold at sixty to seventy-five cents per pound. I knew that one could not get more than one pound of seed from a crate of melons, and had always bought the best melons I could find, paying as high as $3.50 a crate for them. When I was at Rocky Ford, seed from high-grade melons could not be bought from the grower for less than $1.50 per pound. This led me to inquire into the matter, and I found that the high-grade seed was cut from the melons and washed and dried thoroughly, while cheap seed was obtained by tanking the melons. Everything that had ripe seed was allowed to ferment, the juice was drained off and then the seed spread out to dry. Then they were threshed and cleaned, and afterwards even run through a polishing machine to deceive the buyer.

Every grower will now at once realize how much he is imposed upon when he buys cheap cantaloupe seed. I failed to say that the high-grade seed were nearly all cut on orders from large growers in the south and west. I met one large grower in Rocky Ford looking after his seed purchases. He intended buying three hundred pounds, and was expecting to superintend the work and take the seed with him.

Picking cantaloupes for long shipment requires the services of men who are experts. They are picked before they show any tint of yellow, the cavities between the netting having changed from green to a grayish color. At the packing shed they are carefully inspected, graded and packed.

In the matter of marketing, the different associations have systems that assure the grower that he will get all that can be obtained for his product, and we must admit that organization is the only practical way to dispose of such products.

DISCUSSION.

Mr. Riehl—I have grown Burrell's Gem, but the name of the first variety I did not get.

Mr. Wilson—The Waters was the name of the first variety. The Pollock is grown extensively on account of it being immune from the blight and the rust. It is a good deal like the Waters, but nearer to the Gem type.

Mr. Riehl—The Burrell's Gem is a good one. I like it about as well as any of the others.

Mr. Wilson—I should like to say that in a limited way cantaloupes can be grown successfully in Missouri. They require a good deal of care—more than the average farmer is able or willing to give them, but the returns are very encouraging. I grew six acres summer before last and realized something like $1,300.00. I placed these melons on the St. Joe market for the most part. Cantaloupes have to be first class, and the man who tries to sell poor cantaloupes loses his good name and is in the same class as the man who sells rotten apples. The cantaloupe grower should strive for quality and not quantity in order to reap profits.

Mr. Riehl—I should like to ask Mr. Wilson what kind of land he finds best for melon growing.

Mr. Wilson—We have only a small acreage of cantaloupes near St. Joe, because only a small portion of the land around St. Joe produces good melons. About the thinnest land we can get grows good melons, that is, if the land is not exhausted. Cantaloupes do not need much humus, but do need the land to be kept mellow and well cultivated. Then they do not need much moisture. A good crop can be grown with one rain after the plants have started. In fact, they do better with a lack of rain than too much. Strong land grows beautiful vines but no fruit.

IMPRESSIONS OF THE ORCHARDS AND ORCHARD DISTRICTS OF THE WEST.

(By W. L. Howard, Secretary of the State Board of Horticulture.)

The writer has not seen a sufficient number of the orchards of the west and northwest to speak with authority concerning them, but he has seen enough to have received certain impressions.

In the first place, dwellers farther east have always thought of the west as being large in every respect and, unconsciously perhaps, they look forward to finding the orchard districts vast in extent, and the individual orchards very large. Of course, the writer knew better than this, but he was not quite prepared to find the best known apple sections and the most famous individual orchards as small as they really are. Even the famous Hood River valley, the reputation of which extends all over the continent, was found to be very small in extent, relatively speaking. Indeed the total acreage is only 2,250 acres and the bearing apple orchards upon which the reputation of the valley depends, consist of only 750 acres. In Missouri we have individual bearing orchards as large as the last mentioned figures and we have a few, also in bearing, as large as their total acreage.

Furthermore, after a journey from Missouri, to Washington or Oregon, one is impressed by the great distance these centers are from market. Chicago is probably the nearest distributing point for big shipments, which would leave Missouri growers at least a thousand miles nearer than their famous competitors in the far west. These facts leave a very strong impression upon the traveler and cause him to reach the inevitable conclusion that something is wrong when the growers in the far west, with their small orchards and comparatively small orchard districts, can haul their fruit a thousand miles farther than we do and place it on the eastern markets at a far greater profit than the orchardists of Missouri, and the question arises and will not down, as to how they can do it.

After inspecting a few of the apple orchards, talking with the owners and seeing their literature, we begin to see an answer to our question. The fruit growers in the far west, almost without exception, are good business men and in many instances they knew nothing about fruit growing and were not even farmers when they acquired their orchards. Going into fruit business then as they did, unhampered by traditionary ideas and having been accustomed to studying their business enterprises in order to make them yield a profit, they set to work to get the best information available for handling their orchards and put them into practice, and finally, after they had succeeded in growing good fruit, they acquainted the world with what they had done by expending generous sums in advertising.

The districts being new, some experimenting was necessary and this was conducted along practical and common-sense lines. After the trees began to bear, the growers were confronted with the question of markets. Realizing that they were handicapped by distance in competing with the Middle West, they quickly saw that they must overcome this difficulty in some way or their business would fail. This led to shrewd, hard reasoning, and it was decided in the first place, that a superior product must be placed on the market, and that in order to do this, their orchards must receive exceptional care and the fruit packed in a tempting manner. In order to do these things, the growers banded themselves together into organizations, so that everything was done in a systematic manner from the care of the orchards, the exploitation of the crops and products, to the very details of the picking and packing. How well these people have succeeded is well known to those who have followed the prices obtained for their fruit as compared with the money we have gotten. When we come to study the matter carefully, it is found that the fruit growers of the west and northwest have not done anything very wonderful after all. They have merely met conditions as they found them, and by means of their intelligence and business ability proved themselves equal to the occasion. In a certain way, nature even, was against them, as the rainfall was insufficient to furnish the necessary moisture for trees to grow. This difficulty was met by irrigating the orchards and by employing special cultural methods for the conservation of whatever moisture might be introduced into the soil. The valleys being small, and irrigation water being costly, all of which tended to make the land high in price, it was found necessary to plant the trees as closely as they would grow in order to get the largest number possible on an acre.

New problems in the system of pruning adapted to special conditions arose, and were solved. For a time the new districts thought they were immune to attacks from some of the well-known insects, but it was not long until the worst one of them all, the dreaded San Jose scale, made its appearance. In marked contrast to many of the growers of the east and of the Mississippi valley, the orchard owners neither quit the business nor ignored the pest until it had ruined the orchards, but went to work immediately to combat the enemy.

Believing as they do (and they are probably right) that the San Jose scale can never be completely eradicated, methods of spraying have been adopted, which easily hold it in check, and thus they have nothing to fear.

The statement was made that nature had not done much for these people, but it must be admitted that natural conditions, that is, the very dry climate and abundant sunshine during the growing season of fruit, are very unfavorable to the development of certain diseases, like the bitter rot of the apple and brown rot of the peach, still, in place of these they have other troubles, some of which are wholly unknown to us.

Their success is due, then, to the fact that they cultivate only small areas, which enables them to give individual trees the best attention in every respect, including tillage, pruning and spraying.

After growing a fancy product the fruit is packed in fancy packages in a fancy manner, and after paying out large sums in freight charges, they still are able to derive fancy profits because of the fancy prices received. All of this is in striking contrast to conditions at home.

It must be admitted that nature has favored the Missouri grower too much, as the earliest settlers found that they could grow fruit trees with no further effort on their part than merely setting them out. In fact, there are yet to be found remnants of old orchards that were planted by the Indians, and these people certainly never cultivated or sprayed their trees. Our grandfathers, finding that they could grow fruit with such ease, naturally tried to have a few trees. True to our tendency to hand down traditions from generation to generation, our fathers readily absorbed the idea of expecting fruit trees to grow and produce fruit without giving them any attention whatsoever. In support of this, it might be cited that the writer has many times been told by farmers that they would be willing to plant fruit trees for home or commercial orchards, if fruit could be grown with the same ease that their fathers and grandfathers used to tell about. Tradition has held our people, and is still holding them in a very strong grip, and this is standing in the way of our advancement in better methods of orchard management.

It would have been far better for us now, had it not been possible for us to grow trees at all without giving them attention. We would thus have become accustomed to giving our trees the attention they need and have come to understand that if we expected a crop of fruit at all that we must do our share. As it is, nature having done so much for us, we can often secure a partial crop and often a full crop with very little effort on our part. This is really to our disadvantage, as has been pointed out. Furthermore, our growers have often been able to market their fruit to very good advantage, even with their careless methods of sorting and packing.

Our success in fruit growing then has, in the most part, been due, first, to a beneficent nature, and, second, to a non-discriminating public. By non-discriminating public, is meant the people who buy and consume our fruit. However, of late years since the western fruit has been sold in competition with ours, the public has been educated to higher ideals in point of quality of fruit, which has dealt a stunning blow to our growers.

Outside of a few small gardens in the suburbs of large cities, it is safe to say that there is probably not a fruit grower in the whole State of Missouri who lives with his trees both day and night, at least through the critical period of the growth and development of the crop, like the growers of nearly all the districts in the west and northwest.

The Missouri farmer does not think he is doing anything unusual to look after his stock during times of stormy weather, either day or night, and even in his dreams will wonder if the young and helpless animals or poultry are comfortable, but to bestow the same care upon his fruit trees, would, in the judgment of most people, seem to be a mark of weakness.

In the famous peach districts of the Yakima Valley in Washington, fruit growers have told the writer in a perfectly natural manner how they have gotten up at midnight or later, on many occasions, in order to be with their trees during a severe storm, for the purpose of seeing that all the props about the peach trees were in proper order. Growers at other places also related in a manner that showed that they were not doing anything unusual, how they had worked all night on certain occasions, in order to protect their fruit trees with smudges of burning oil to prevent injury from frost. Other instances of this kind might be enumerated, and when we, of the Middle West, make up our minds to do the same with our trees, then, and not until then, will we succeed as we might.

In conclusion, it may be said that it is possible for Missouri orchardist to produce a superior quality of fruit at a far less cost than the west can, and this, combined with our nearness to market and great saving in freight, will, if we wake up to the fact and conduct our business along business lines, treat our orchards as they should be treated, make of fruit growing a main industry instead of a side line—enable us to reap profits as large and as continuous as growers in any other part of the United States.

SOME THOUGHTS ON PLANT-BREEDING.

(By Prof. H. J. Webber, Cornell University.

As you are fruit-growers, I take it that you are all interested in breeding. I could probably talk to you most authoritatively about the breeding of timothy hay, as my largest experiment at present is with that crop, but you are probably more interested in the breeding of fruits. You may remember the story of the minister who said, in one of his Sunday morning addresses, "There is a sermon in every blade of grass." A parishioner, passing by the house of the minister the day following the preaching of the sermon, and finding the minister cutting his grass, called to him and said, "Good morning, Parson. Am glad to see you cutting your sermons short." What I want to emphasize is that there is truly a sermon in every blade of grass, in every tree, in every bud, and it is for us, gentlemen, to learn what that sermon is. I wonder if we have been doing our full duty as citizens of this twentieth century. I wonder how many have read the words of Russell Wallace with reference to the advancement in the last century. Wallace characterizes the last century as one of despoilation. Nature gave to this country great mineral wealth, rich agricultural soils, and forests of fabulous value. In our mad search for wealth we have been using these resources without any reference to future generations. It is high time to pause and question what legacy we are leaving to our children. I think it is about time for us to stop now, as horticulturists, and inquire whether we are leaving what we should to the coming generation. It is important occasionally to look back and see what advance has been made. It is a surprising thing that the good old standard varieties of apples, pears and peaches were mostly originated many years ago, so long ago that we can hardly remember when they appeared—the Baldwin apple at the end of the 18th century; the standard varieties of grapes at the beginning of the last century; and so it is with almost all of the standard varieties.

Now, are we doing our duty? Are we doing what we should along the line of producing improved varieties, so that the fruits of the next generation will be improvements over those we cultivate? I believe we owe it to the next generation to spend more time in the improvement of our crops in a fundamental way. Burbank has emphasized the importance of this question of the breeding of fruits and flowers, and I want to emphasize it even more, if possible. We must leave something of value for future generations, and I want to say that we need not recognize it as a disagreeable duty, because it is one of the most pleasant duties we can possibly have. No wonder the complaint is going out that our boys are leaving the farms. *Why* are they leaving the farms? Because they are not satisfied with what they see in farming pursuits. Would they leave the farms if they saw the possibilities of advancement in this field that they see in other lines of industry? Why, bless your soul, no.

It seems to me, therefore, that the point to emphasize is the simple fact that there is no greater opportunity for achievement offered anywhere on the face of the earth than that which is possible on the farm. The boy who is searching for advancement will never make that advancement anywhere else more easily than on the farm, if he has the right ideals. It, therefore, becomes the duty of the instructor, of the teacher, of the father and of the mother, to instill the right ideas into the child as to what can be accomplished on the farm.

We, as scientific men, sometimes criticise Burbank. But there is no man interested in horticulture in this country, or in any other country, who is recognized as a greater man in his line than Burbank, and why? Because Burbank has opened up a great subject. You may not grow Burbank plums, you may not grow Burbank potatoes, you may not believe in the value of the spineless cactus, but these in the last analysis are not the achievements, as I conceive it, on which Burbank's reputation rests. His reputation rests on the fact that he popularized breeding, and has made it possible for me and for many other investigators to make a better scientific study of these problems. We owe it largely to Burbank that we are employed to study these problems of breeding. Therefore, he has made it possible for hundreds of men to work and accomplish things where he himself, with his single pair of hands, could otherwise work and accomplish but little.

Well, now, Burbank has been successful, as I understand success. That is what we are all working for. That is what we all want to accomplish. I believe that the boy on the farm who has ordinary ability can accomplish that success and make himself famous over this entire country by study, perseverance and enthusiasm in work.

You may remember the story of the Burbank potato; how Burbank originated this potato, which is now recognized as a standard of excellence, when a mere boy. In Washington, D. C., when a huckster comes around to sell potatoes and is asked what variety he has, he will always say, "Burbank's," because the housewife is then satisfied that the potato is all right. Burbank originated this potato when a boy in knee-breeches, and it was probably this first success that encouraged him to go ahead and achieve the success which he has in different lines of breeding. Some breeders have made the serious mistake of attempting to invest breeding with the idea of occultism, so to speak. The successful breeder becomes a wizard, his knowledge intuitive and secret, hard to get at and understand. I want to tell you that I have been studying this subject as a speciality for the last twelve years, and fail to find where it is occult or difficult. The ordinary man succeeds just the same as the scientific man. You can, of course, go just as deeply into the science of a thing as you want to. You can make the subject just as scientific as you desire, but you don't need all the deepest scientific knowledge to practice the art. You know that you can plow just as well without knowing the scientific reasons why plowing is necessary. In other words, there is in breeding a field of art and a field of science. In both of these fields, the practical and the scientific, we are studying and advancing rapidly. The great practical results of breeding are not those of scientific men, but of the common farmers. We want farmers all over the country to take up the breeding plants and the selecting of varieties of improved apples, peaches, pears, and they can do it and accomplish something, too. I can cite you examples of boys here and there who are starting successful careers. I can even tell you of boys, twenty-one or twenty-two years of age, whose names are recognized in a dozen different states simply because they have taken up this subject of breeding, and are succeeding. Therefore, I want to maintain that there is no field of human endeavor, or of human activity, where a man of ordinary ability stands a better chance of succeeding than on the farm, working with fruits and farm products.

If this is the case, shall we allow our boys to go away from the farm to find something of interest to them? No, we must put it before them in the right light and show them the possibilities of advancement. We must show them that they can do work which will be recognized all over the country, and I believe it will be possible to interest them and keep them on the farm of their own desire and volition.

I want also to say a few words to you, as horticulturists, on the subject of bud variations. You probably all know the peculiarities of bud variations. We know that occasionally a tree will produce on one branch a variety of fruit different from that on the rest of the tree, and the same is true with flowers. The cause of this is in the bud, the process of change apparently taking place in the bud, instead of through the seed and sexual reproduction. I want to impress strongly on you the complex nature of a tree and the fact that every bud on a tree differs from every other bud on that tree. As simple and fundamental a truth as this is, yet we scarcely recognize it, because in the State of New York, one of the leading fruit-growing states, I have failed to find an orchard where the buds have been selected. You know that it is generally recognized that buds ought to reproduce their kind. If we take a bud from a Baldwin apple tree, it ought to produce a Baldwin apple; but you horticulturists know that if we take a Baldwin apple from Colorado and one from Washington and one from Arizona, where there are marked differences in climate and altitude, and compare them with Baldwins, grown in New York, they will be found to be of different shapes, color and flavor. They are markedly different as a result of the different environments. How many of you can tell me whether, if we take buds from these trees that have been growing for many different bud generations under markedly different conditions, and grow them in the same place, they will produce exactly the same thing or not? I find no evidence on record that will enable us to answer this question. We know that the Newtown Pippin, originating on Long Island, has varied in Virginia into the Albemarle Pippin. In the extreme northwest it produces a somewhat ribbed fruit, and in Australia the fruit is markedly ribbed, and is known as the Ribbed Pippin. Yet all the buds of these markedly different forms were taken from the same original tree. We know that if we examine the trees in an orchard of Baldwin apples, we may find one tree that will produce well, and another, immediately by its side, which is a poor producer, and yet they are both Baldwin apples. Both have all the characteristics of Baldwin; one, however, is a good producer and the other is not. You know that if you go into a house of Enchantress carnations, and examine the plants, you will find great differences, although all are from the same original plant. One plant will produce only three or four good flowers a year; another will produce fifteen, while on some superb plants the yield may be twenty-five flowers, or even more, in a year. These good plants are the ones that are bringing in the money. Now, all of our experience goes to show that if we select our propagating stock from plants which are the most bountiful producers, we will get strong, productive strains. Dr. Galloway and Mr. Dorsett, of the Department of Agriculture, at Washington, found that they could increase the yield of violets over double by the careful selection of stock from productive plants.

With all of this evidence before us, why is it that we go right along and propagate our orchards and different fruits with almost no reference to the quality of the buds taken, or the place from which the buds came? There is an orchard to be put out which will stand for a hundred years; an orchard which we put out for our children largely, and our children's children; it will cost us but very little more to select the buds so that we know that everyone was taken from a certain tree of a certain productiveness and quality, and this is the only way that we can be sure that we are putting out the very best strains of the best varieties, and I want to emphasize this as being one of the important things which experience has shown me should be given careful attention. Practical horticulturists generally believe in the soundness of this principle.

And now, a final word: If you candidly believe these things, don't pass them by as meaningless; but when you put out your next orchard, put them into actual operation.

VISITING REPRESENTATIVES.

President Stark introduced Prof. Emerson, who was a delegate of the Nebraska State Horticultural Society to the Winter Institute. He spoke a few words of pleasant greeting and praised highly the work that the Missouri Experiment Station was doing along the lines of hardiness under Mr. Chandler's direction. He said that anything the State Board did for Missouri along horticulture lines, she helped her sister states, and Nebraska was thankful for this help.

Mr. Riehl from the State Horticultural Society of Illinois was introduced to the assemblage and told of the beginnings of the Missouri Society. He said what the State should strive for now was to reclaim the abandoned orchards by teaching better management, better methods, better horticulture.

Mr. Culp of Illinois was presented as a delegate from the American Apple Growers' Congress. He spoke for the fight for better orchards in Illinois, and told what they expected the Legislature to do for them this year. He urged co-operation and a higher standard of packing and grading.

Major Holsinger, delegate from Kansas, told what they were doing in a horticultural way in the "great desert" beyond Missouri's western boundary. He said that Missouri had not yet wakened to her opportunities in horticulture; that the 20,000,000 trees could be made to produce ten-fold under proper management and an understanding of conditions. He was very enthusiastic about the coming season and hoped to see a bumper crop of fruit.

Mr. Wilmeroth was called on for a talk, but he said that he said enough the night before. Expressed his delight in seeing the Missouri fruit growers interested in such live topics.

Mr. Stark at this point opened up a box of Delicious apples, and had them passed around among those present. He was asked to tell about the origin of the Delicious, and in part he said: "Jesse Hyatt of Peru, Iowa, originated the variety. Mr. Hyatt made considerable effort to have horticultural societies over the country take it up, but without success. Finally, just before he died, he came to us with his apple, saying that he believed that he had something that would do humanity good. The barrel he sent us was the most highly colored of any that we have ever seen. We have gotten reports on this apple from Arkansas, Iowa, Maine, Montana and everywhere, there has come to us good reports concerning it. I will say further that the old tree is still standing in the Hyatt orchard, where most of the other trees have fallen."

PREMIUMS AWARDED.

(Winter Institute.)

The Committee on Awards, i. e., the judges of the fruit exhibit were: Prof. R. A. Emerson, C. W. Wilmeroth and Maj. Holsinger. The report follows:

Your judges, while not in position to give prizes on apples grown outside of the State of Missouri, wish to make special mention of the display of nine varieties by Stark Bros. Nursery and Orchard Company of Louisiana, Mo., consisting of Delicious, King David, Chicago, Stayman Winesap, Champion, Ben Hur, Spitzenburg, Senator, and Grimes Golden. Also, of the sixteen varieties of Wenatchee, Washington, apples entered by the Great Northern railroad, represented by Messrs. E. C. Leedy and Max Bass, general immigration agents, with headquarters at Chicago. Delicious, Spitzenburg, Hoover, Yellow Newton, White Winter Pearmain, White Winter Banana, Yellow Bellflower, Stayman Winesap, Gano, Rome Beauty, Grimes Golden, Winesap, Ben Davis, Missouri Pippin, Black Ben Davis, Arkansas Black; also, specimens of Winter Bartlett pears weighing two pounds each. Mention should also be made of the exhibit of Holsinger Bros., Rosedale, Kas., grown on the "Great Desert" of Kansas (that was), being fine specimens of native apples, consisting of Stayman Winesap, Huntsman, York Imperial, Ben Davis, Winesap, Arkansas Black, White Pippin, White Winter Pearmain, Red Winter Pearmain, Genitons. The Ben Kress exhibit of McIntosh Red, Fameuse and Alexander from the Bitter Root Valley, Hamilton, Mont., the exhibit of J. H. Shawhan, Payette, Idaho, and the exhibit of the different varieties from the orchard of E. J. Matthews, Paonia, Colorado, should also be mentioned in this list. Mr. E. A. Riehl, Alton, Ill., had a very fine exhibit of chestnuts, consisting of eleven varieties. Mr. Riehl recommended planting chestnuts on all proper well-drained soils.

Special mention should also be made of the box of fancy Spitzenburgs sent by Will Scoville of the Rogue River Fruit Exchange, Rogue River, Oregon.

1. Best collection of apples of not less than 6 nor more than 15 varieties:

First, State Horticultural Society, Springfield.......	$20 00
Second, L. J. Hartman, St. Joseph.................	10 00
Third, J. R. Wilson, DeKalb......................	5 00

2. Best four varieties of Winter Apples:	
First, R. M. Hitt, Koshkonong	3 00
Second, A. P. Shonse, Weston	2 00
3. Best four varieties Winter Apples for family use:	
First, L. D. May, DeKalb	3 00
Second, Thos. Butler, Amity	2 00
4. Best three varieties Fall Apples for market:	
First, State Horticultural Society, Springfield	3 00
Second. L. J. Hartman, St. Joseph	2 00
5. Best single variety Winter Apple for market:	
First, State Horticultural Society, Springfield	2 00
Second, State Horticultural Society, Springfield	1 00
6. Best single variety Winter Apple for family use:	
First, W. S. Burlingame, Olean	2 00
Second, A. K. Colley, Orrick	1 00
7. Best single variety Fall Apple for market:	
First, J. R. Wilson, DeKalb	2 00
Second, L. J. Hartman, St. Joseph	1 00
8. Best single variety Fall Apple for family use:	
First, L. J. Hartman, St. Joseph	2 00
Second, J. R. Wilson, DeKalb	1 00
9. Best plate of Ben Davis:	
First, State Horticultural Society, Springfield	2 00
Second, A. P. Shonse, Weston	1 00
10. Best plate of Gano:	
First, J. R. Wilson, DeKalb	2 00
Second, State Horticultural Society, Springfield	1 00
11. Best plate of Jonathan:	
First, L. J. Hartman, St. Joe	2 00
Second, J. R. Wilson, DeKalb	1 00
12. Best plate of York:	
First, State Horticultural Society, Springfield	2 00
Second, L. J. Hartman, St. Joe	1 00
13. Best plate of Grimes Golden:	
First, L. J. Hartman, St. Joe	2 00
Second, J. R. Wilson, DeKalb	1 00
14. Best plate Ingram:	
First, State Horticultural Society, Springfield	2 00
Second, L. J. Hartman, St. Joe	1 00
15. Best plate Winesap:	
First, R. M. Hitt, Koshkonong	2 00

Second, State Horticultural Society, Springfield	1 00
16. Best plate Missouri Pippin:	
First, State Horticultural Society, Springfield	2 00
Second, R. M. Hitt, Koshkonong	1 00
17. Best plate Huntsman:	
First, Henry Schnell, Glasgow	2 00
Second, L. D. May, DeKalb	1 00
18. Best plate Rome Beauty:	
First, R. M. Hitt, Koshkonong	2 00
Second, R. M. Hitt, Koshkonong	1 00
19. Best plate Payne's Keeper:	
First State Horticultural Society, Springfield	2 00
No second awarded.	
20. Best plate Kieffer pears:	
1st, J. R. Wilson, DeKalb	2 00
2nd, Thos. Butler, Amity	1 00
Special (Not listed in Premium List).	
21. Mammoth Black Twig:	
1st, A. K. Colley, Orrick	1 50
2nd, L. J. Hartman, St. Joe	75
22. Spitzenburg:	
1st, State Horticultural Society, Springfield	1 50
23. Lansingburg:	
1st, J. W. Weaver, Milo	1 50
2nd, S. D. Gregg, Independence	75
24. White Winter Pearmain:	
1st, State Horticultural Society, Springfield	1 50
25. Rox Russet:	
1st, J. R. Wilson, DeKalb	1 50
2nd, Thos. Butler, Amity	75
26. Yellow Bellflower:	
1st, L. J. Hartman, St. Joe	1 50
27. Minkler:	
1st, L. J. Hartman, St. Joe	1 50
28. Northwestern Greening:	
1st, J. R. Wilson, DeKalb	1 50
29. Willow Twig:	
1st, State Horticultural Society, Springfield	1 50
2nd, L. D. May, DeKalb	75
30. Ralls Genet:	
1st, State Horticultural Society, Springfield	1 50
2nd, J. R. Wilson, DeKalb	75

31.	Japanese Walnuts:	
	1st, Henry Schnell, Glasgow	1 50
32.	Pecans:	
	1st, H. F. Blankenbaker, New Franklin	1 50
	2nd, Guy Blankenbaker, New Franklin	75

NICHOLAS FREMONT MURRAY.

Nicholas Fremont Murray, member of the Missouri State Board of Horticulture, died suddenly in Kansas City, Mo., May 26, 1908, in his sixty-ninth year. By resolution of the Board, in June, 1908, this memorial tribute is included in the annual report of the Board.

Mr. Murray was born near Wheeling, in Ohio county, Virginia, March 17, 1839. He was married in the same county, on November 6, 1860, to Miss Emily F. Whitham, who died September 30, 1865, leaving a daughter, now Mrs. Charles Childers. On May 9, 1867, he was married to Miss Elizabeth J. Riggle, in Washington county, Pa., who is yet living. Of this marriage four children survive: George and Joseph of Holt county, Mo.; Mrs. Alberta Kunkel, of Anadarko, Okla., and Mrs. Minnie Cunningham, a Presbyterian missionary at Benito, West Africa.

Mr. Murray served through the Civil War, and was commissioned by President Lincoln as captain of Company C, one hundred and sixty-first regiment of state troops.

In 1869, Mr. Murray removed to Missouri, and located in Holt county, near Oregon, the county seat. A few years later he established The Holt County Nurseries, and at about the same time became interested in growing fruit commercially. To the day of his death he was interested in horticulture, and still retained a large orchard in his county.

Mr. Murray was for years a member of the Missouri State Horticultural Society, and held many offices in that organization; for several years he served as president. When the Missouri State Horticultural Society was succeeded by the Missouri State Board of Horticulture, he was appointed as the member from his district, which place he held at the time of his death.

At various times Mr. Murray lectured on horticultural topics before the classes in horticulture at the Missouri Agricultural College, and for many years was on the staff of lecturers at farmers' institutes in the State.

Mr. Murray was honored by the people of his county with public office on a number of occasions. He served as member of the Legislature from Holt county for two terms, from 1892 to 1895, and during the last term was chairman of the agricultural committee of the house. During this term he championed a number of bills for the advancement of agriculture in Missouri, some of which were enacted into laws.

At the time of his death Mr. Murray was a delegate to the General Assembly of the Presbyterian Church in Kansas City. He had been in his usual good health, and early in the morning of May 26 awakened his wife and told her he was sick; doctors were hurriedly called, but Mr. Murray died at once of heart failure.

The foregoing paragraphs briefly tell the story of this good man's life. The deceased was not only a good citizen, but he was one who was intimately connected with the horticultural development of Missouri. As nurseryman and fruit-grower he was always an optimist; he believed in Missouri as a fruit-growing State, and his advice and his counsel did much to encourage the planting of what are now some of the best orchards in Missouri. He was ever ready to give the benefit of his experience to others who wanted to grow fruit, and his works will live after him. Missouri needed men like Mr. Murray, and the State is the better for his having lived in it. Few men had a wider personal acquaintance among the people of the State, or more friends, who, with the members of this Board, remember with great satisfaction the life and the works of Nicholas Fremont Murray.

WAYNE COUNTY HORTICULTURAL SOCIETY.

(Extract from a talk given before the above Society by R. M. Hitt, Koshkonong, Mo., at Wappapello, September 19, 1908.)

Ladies and Gentlemen, and Members of the Wayne County Horticultural Society:

It gives me a great deal of pleasure to be with you at this, your thirteenth annual fair, and when I say this, I speak what I honestly feel, because I have met and exchanged ideas with a great many engaged in the same pursuit in life as myself; namely, that of horticulture.

I find that a great many of you have supposed that I am a scientific horticulturist and are expecting a talk on scientific lines, but you are mistaken, as all the scientific knowledge I possess is that gained in the practical application of scientific knowledge produced by others.

Your secretary asked for a practical talk on horticulture and a word of encouragement, to induce larger plantings of orchards. The subject of horticulture is a broad one, and it would be impossible for me to talk upon it in detail, but will try and touch some of the points necessary in successful fruit growing.

I drove from Greenville yesterday, 18 miles through your county, and although I did not get out of the buggy, I watched the country to judge as to its adaptability to fruit growing. You have land very similar to that in the Ozark country west of here, and I see no reason why you have not as good a fruit country as that. In fact, you have the advantage over some sections in not having so much surface rock. This country seems to be especially well adapted to the growing of pears, peaches and apples, and your display of fruit at this fair goes to prove this to be a fact. If you have the soil and climate, I don't know how I can speak encouragement any more forcibly than to tell you that at Koshkonong in your neighboring county of Oregon, with a light crop for the number of trees, there were about 80 cars of Elberta peaches shipped this year, which returned to the growers over $50,000.00. If this amount of money were brought into your community would you not all feel its effects? Your land would increase in value and your school and church buildings grow in size and number. My friend, Mr. Bower, has talked to you upon educational lines, and I want to emphasize what he has said, especially with regard to the education of our boys for good agriculturists and horticulturists. The time is not far distant when it will be just as necessary for the farm boy, if he wishes to keep abreast of his neighbors, to get a college education for farming, truck growing and fruit growing, as it now is if he wishes to practice law, medicine or any professional or scientific calling. The colleges over the land have realized this fact, and nearly all have a course devoted entirely to the teaching of horticulture.

There is an education within the reach of all of us who are now engaged in fruit growing. If we will get and study the free bulletins published by the Department of Agriculture at Washington and by Experiment Stations at home.

Your apples on display in the school house are fine as to size, and most of them have good color, but there is hardly an apple on the tables that has not been stung by codling moth. Now this is easily corrected by spraying, and if you intend to grow apples for commercial purposes you had best prepare yourselves, because it is an absolute necessity if you wish to grow marketable apples. Spraying your trees not only makes perfect fruit, but healthy trees as well. I have seen apple trees all over the south part of the State that have lost their foliage, some of them as early as the middle of August. This is not a natural condition, and one of the best ways to correct it is by spraying, pruning and cultivating, and thus keeping the trees in a healthy state. We must get over the idea that all that is necessary to grow fruit is to connect the trees with the soil and then sit down and wait for them to bear. They must have constant care and attention if we would have them produce perfect fruit in paying quantities.

I understand you have not grown fruit in this county in a commercial way. Your home consumption has been sufficient to take all you produce. Now when this condition changes and you have to ship some of your fruit to other markets, be sure to get started on the right track. Don't think that you can pick and handle your fruit for shipment to New York and Boston the same as you do now to haul it to your county seat, Greenville. This is the cause of failure many times, and fruit men, generally, over the State need education in picking, packing and marketing their products.

In conclusion, let me say, grow the best; ship the best; pack it right, and you will receive the highest rewards for your efforts.

MISCELLANEOUS PAPERS.

MISCELLANEOUS PAPERS.

MISSOURI APPLE GROWING.

(By J. C. Whitten, Horticulturist, Missouri Agricultural Experiment Station.)

Soil and Location—Generally speaking, apples trees thrive best upon light, well drained land. A gravelly sub-soil is preferable to stiff clay. In fact, the subsoil is of more importance than the surface soil itself. Hilly, broken places are usually better than level, flat areas. Many rugged hillsides along our rivers too steep for ordinary tillage are excellent for apple orchards. The deep, loamy "loess" soil along our great rivers and some of our tributaries, and the red soils of the broken Ozark region are among the very best apple soils. While some soils are better than others, almost any farm in the State is capable of producing a good family orchard, that will many times repay for the trouble and expense of growing it. Good drainage, to allow the roots to penetrate, is more essential than richness of soil, so the less tillable places on the farm may be selected for the orchard.

Where there is opportunity for a choice of slope the local conditions and varieties to be planted govern somewhat the site that should be selected. Often a northern or eastern slope is to be preferred. On rocky, thin soils the northern slopes are usually richer and they stand the drought better than the southern slope. The buds start later on a northern slope, and are more liable to escape late spring frosts. Other things being equal, the fruit is usually higher colored and it seems to be better flavored on the southern slope. If proper attention is given to the selection of varieties, apples may be grown successfully if soil conditions are right. Low, damp places should be avoided.

The character of the native forest trees indicate to some extent the fitness of the land for apple trees. Where the nut trees, sugar maple, poplar, papaw, linn or sumac thrive apples usually do well. The larger and finer the growth of these native trees, the stronger the indication that an orchard will thrive there.

Varieties.—Among the leading varieties in the commercial orchards of the State are: Ben Davis, Gano, Jonathan, York, Missouri Pippin, Winesap, Grimes, Ingram, Delicious and Rome Beauty. The leading commercial varieties of summer apples are Maiden's Blush and Wealthy. Other sorts like Genet, Paynes Keeper, Huntsman and Mammoth Black Twig are sometimes propagated. Ben Davis and Gano, two varieties that are very much alike, are the leading commercial sorts. These two varieties are more largely grown in Missouri that all other sorts combined. In most localities experienced growers recommend planting at least half their orchard to these varieties. The trees bear heavily and the fruit ships better than almost any other sort, and they are among the best cooking apples. Their quality, however, is not the best. They are remarkably cosmopolitan, succeeding well in all parts of the State.

Next to these two sorts the Jonathan is perhaps the most popular general commercial variety. It is of the richest red color and the highest flavor. It is productive throughout the State. The Jonathan ripens earlier than the Ben Davis or Gano, and is not so good a keeper. In cold storage, however, it will keep perfectly until late winter or early spring, and as a dessert fruit it is one of the best of the State.

The York is unexcelled in size, quality and appearance as a commercial variety. In some parts of the State it produces well. It is a splendid keeper, and gaining in popularity, particularly in certain sections of Missouri. It is one of the most profitable varieties to grow on the "loess" formation along the Missouri river hills. It has the fault of scalding somewhat if kept either too cold or too hot in storage.

Grimes is unexcelled in quality, and has a rich yellow color; it is neither a strong grower nor a heavy bearer, except in certain localities. It is one of the finest dessert fruits, brings the highest price on the markets, and where it thrives well, is very profitable. It requires a rich soil.

The Missouri Pippin is planted commercially to some extent. It is good color, but not the best in quality. It is one of the earliest to come into bearing and, perhaps, on this account, and a tendency to overbear, the fruit tends to be of small size after the first few crops. A small portion of this sort will be profitable in some localities.

The Winesap is of good color and of good flavor, as well as one of the best keepers. In some localities it is undersized and not of sufficient vigor and productiveness. Generally speaking, it ranks as one of the commercial varieties in this State. It blossoms somewhat late and usually escapes spring frosts.

Ingram is one of the best keepers, and of fair quality. Generally speaking, it is more profitable in the southern part of the State than in the northern. In one section of Southwest Missouri it is one of the most profitable varieties. It is particularly adapted to soils that are too low and cold for the best development of other sorts. It blossoms very late in spring, and is quite safe from spring frosts.

It is well to bear in mind that some of the above varieties are cosmopolitan in their adaptability to conditions, while others are to be especially commended only for certain soils and localities. Ben Davis, Gano and Jonathan are generally well adapted to all soils slopes and localities in the State. Winesap, Mammoth Black Twig, York and Rome Beauty succeed well on southern slopes and on thin land. Genet, Ingram and Rome Beauty are among the best to select for moderately low land. They blossom late and are seldom killed by late frosts.

When selecting varieties for a commercial orchard it is of the highest importance that we study the varieties already growing in the locality, especially in similar soils, and where the altitude and other conditions are the same. More information may be gained in this way than by any printed list. A commercial orchard should contain from three to six leading sorts, and these may be generally selected from the varieties discussed above.

For a home orchard the main planting should be of the commercial varieties just mentioned, considering that they are usually good keepers, and will supply the family needs throughout the winter. In addition, a few trees each of some earlier sorts should be included, to give a succession of fruit from early summer until late ones are ripe. Such varieties as Yellow Transparent, Early Harvest, Red Astrachan, Sweet June, Red June, Rambo, Benoni, Maiden's Blush and Chenango Strawberry, make a good general list.

It is of less importance to give directions for selecting an orchard for home use than it is for market, because in the former case the grower should suit the taste of himself and family, and those varieties should be grown, while in the latter case the most profitable sorts for commercial purposes are restricted to a few varieties.

Previous Preparation of Land.—Where new woodlands are to be cleared and planted it is best to clear the land and plant the apple trees the following spring. The clearing may be begun any time after August first. It is best to cut the stumps as low as possible, none being left higher than one-half their diameter. This allows working the ground well, as the implements will pass over the low stumps, where they would catch on the higher ones.

After the land is cleared it may be plowed at any time that it is workable,, before the time comes for setting the trees in early spring. Where the nature of the soil will permit, the turning plow should be used, plowing as close to the stumps as possible. A heavy A harrow, with teeth long and heavy enough to slide over the low stumps, is usually employed for fining the land after plowing. Where the land is too rough or stony to use a turning plow, a "Single-Shovel" or "Bull-Tongue," with standing coulter to cut the roots, is often used.

Old farm land that has been long in cultivation should be plowed as deeply as practicable and harrowed well. If the land lacks humus or is subject to washing, a crop of cowpeas or clover should be grown and plowed under before planting the orchard.

Many rugged hillsides that are too stony to plow or cultivate, may be profitably planted to apples. A small circle can be cultivated around each tree with a hoe, pick or grubbing hoe, and the rest of the ground seeded to clover, or eventually allowed to grow up to bluegrass. The growth between the trees should be frequently mowed down the first few years, until the trees are well established, then it may be either mowed, or in some cases, pastured. Where orchards are allowed to stand in sod, enough of the grass or clover should be left on the ground to make a good mulch. It should never be pastured too closely. Trees managed in this way on steep, rocky places, often do as well as cultivated trees do on larger areas. They have perfect drainage, and their roots anchor themselves deep among the rocks, so that cultivation is less essential than it is in some other soils.

After land is properly plowed and harrowed, the tree rows are usually marked out with a team and marker of some kind. A single shovel or other tool may be used. On small areas a chain may be dragged by a man to mark it. In large areas dead furrows are sometimes opened in check rows across the ground, which assists materially in digging the holes for the trees. Wherever a tree is to stand, four furrows have been turned out, thus nearly digging the hole for the trees.

There is no stated distance apart which trees should be planted. Perhaps the most common distance is to plant the trees twenty-five feet apart in check rows. At this distance it requires about seventy trees to plant an acre. This, in the writer's judgment, is the best distance to recommend. Some plant thirty feet apart, and then plant a tree of such variety as Missouri Pippin between these running north and south. This makes the trees fifteen feet apart one way and thirty feet apart the other. When the permanent trees need the room the temporary ones should be cut out. Planting temporary trees, or fillers, is not generally to be recommended, however. The grower usually allows them to stand too long, not having the courage to cut out young trees in their prime.

Selecting Trees.—Two-year-old apple trees are usually best for planting. Correspondence with the leading orchardists shows that more than three-fourths of them prefer two-year-old trees. In the Station grounds, where we have planted trees of various ages for a good many years, the two-year-olds have universally given the best results, considering the expense of handling, the subsequent care they need, etc. A few growers prefer large one-year-old trees, but they generally admit that these require more careful cultivation for the first year or two to get them established. Occasionally a grower prefers three-year-old trees. If carefully taken up with a good root-system and planted nearby, so that they are not handled much, three-year-old trees may be transplanted so that they will do well. If dug with an ordinary nursery tree digger, so that the root system is cut quite short, and are packed and shipped, three-year-old trees are liable to give unsatisfactory results.

Other things being equal, it is best to secure trees from your home nurserymen. They generally know what varieties will succeed best in your neighborhood, and can give many special cultural directions and other valuable advice. The nurseryman should be a kind of horticultural educator in his community. In selecting home-grown trees, one is not liable to introduce insects or diseases which are not already in the neighborhood. Again, one can have the opportunity and advantage of visiting the nursery and selecting the trees he wants. One should plant straight, symmetrical and vigorous trees, but not necessarily the largest ones. Avoid badly forked trees, or those that are headed at the wrong height.

Planting.—In planting, the holes should be dug deep enough and broad enough to accommodate the natural spread of the roots. We often hear it recommended to dig very large, deep holes, to fill them with miscellaneous material and then plant the trees. If the trees are to be planted on the lawn, where the grass grows, it is perhaps well to dig a large hole in order to kill the grass roots for a considerable space about the trees. In planting in the commercial orchard, however, where the soil is to be tilled, the general plowing and tillage fits the entire land for the best growth of the tree, so that especially large holes are not necessary. When the tree is to be set, it should be held in the hole so its largest branches are extended towards the south or southwest, in order to shade the trunk from the sun. It should be set as deeply as it stood in the nursery, and should stand straight. It should also be in line with the other trees in the row, so the row will be straight. The trees should be set firmly and no air spaces should be left about the roots. To accomplish this the shovel should be shaken in throwing in the earth, so as to scatter it among the roots instead of putting it into the hole in compact masses. The tree should also be shaken up and down until the earth begins to cover well the roots, in order that the soil may be worked well into all the crevices. As soon as the earth is put into the hole, tramp it firmly with the foot, so that it will be left firm from the bottom up. If one tries filing the hole and then tramping, the earth will not be firm at the bottom and the roots will dry out. An inch of loose soil should be spread about the tree to prevent baking of the soil.

It is usually best to set trees in early spring, but if the land is moist and other conditions favorable, they may be set in autumn. If the soil and atmospheric conditions are favorable, autumn planting has the advantage of getting the work out of the way instead of delaying it until the more busy months of spring. If the autumn is very dry, however, it is usually advisable to delay planting until spring, as transplanted trees under these circumstances are liable to dry out and suffer during winter.

Pruning.—At the time of planting, the root-system of young trees should be pruned just enough to remove any mangled or broken roots; to make a smooth, instead of a ragged wound, and to shorten long or straggling roots to six or eight inches in length. It is better to cut off part of a long root than to double it up in the hole at the time of planting. It has been advised in pruning large roots, to hold the tree in the hand with the top downward, so that the wound will be made on the lower surface of the root.

Experiments, however, have shown no advantage in this method over that of cutting from the top downward, so that the wound occurs on the upper surface of the root. The essential point is, that the soil should come in close contact with the wound, in which case the wound callouses, and emits new roots, regardless of the position of the wound; the side branches or limbs above ground should be shortened somewhat to balance the reduced root-system, but a straight central trunk or leader should be maintained. If a tree is forked, one side of the fork should be cut to a few inches in length. If limbs occur below the head (place where the tree should branch), they should be cut off as close to the trunk as possible, unless they are so large that the cut will make a dangerous wound, when they should be shortened to a few inches in length to prevent their making much growth, and the stubs remaining should be removed entirely the next season.

One-year-old trees that have not branched after transplanting, will throw out a few branches near their tops, thus forming heads at that height. To prevent their heading too high, they may be cut off about six or eight inches above the height at which it is decided to have the head form.

As a rule, low heads are preferred in this section. Some extensive apple growers prefer to head their trees as low as one foot from the ground, while others still advocate the old method of heading them high enough so that a team can walk under the branches. The majority prefer to head their trees about two feet above the ground. The tendency is toward lower rather than higher heads, formerly recommended.

The subsequent annual pruning of apple trees is a matter of considerable importance. Most of the pruning is usually done during the winter. The fruit grower usually has more time at command in winter than in summer. Judicious pruning may be done at almost any season, however, except, perhaps, during the short period when the trees would bleed, in spring, and it is highly desirable to remove dead, broken, injured or diseased parts whenever they occur.

Those in this State who prune, usually prune too much rather than too little. Others make an equally serious mistake of pruning none at all. While some pruning should be done annually, the aim in this climate should be to make strong, compact, dense heads, rather than open ones. More pruning should be done during the first few years while the trees are being shaped than later.

One of the first considerations is to aim to maintain a straight

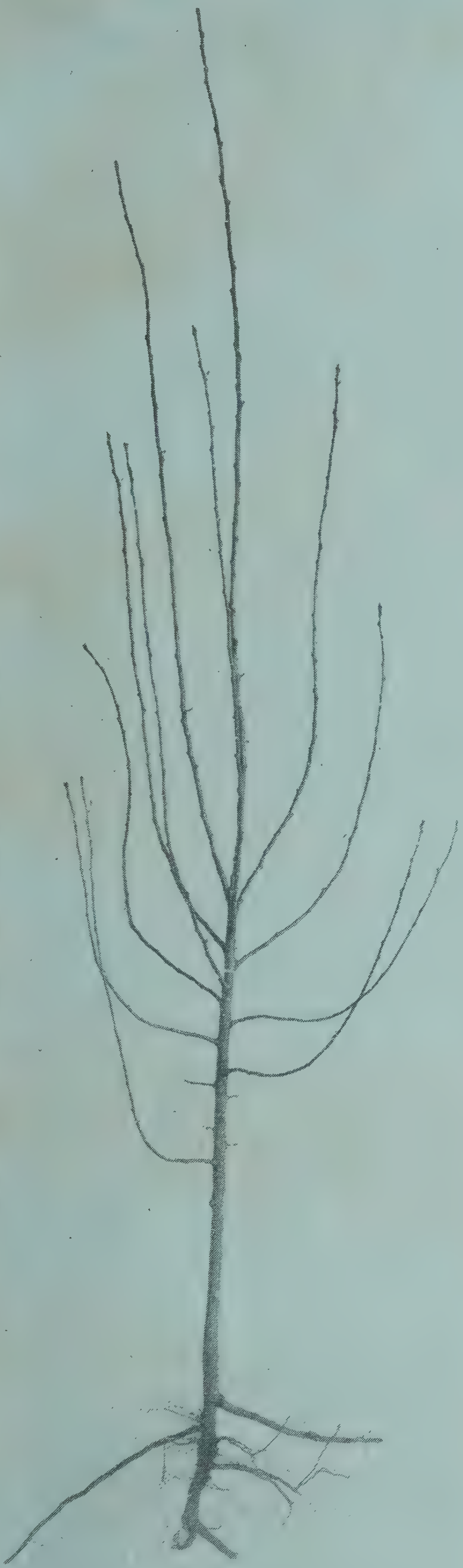


FIG. 1.

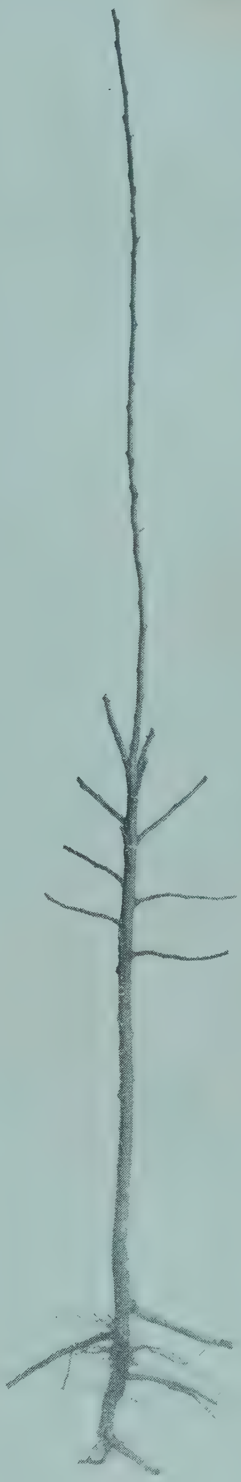


FIG. 2.

Figure 1. Typical two-year-old apple tree before pruning to plant.
Figure 2. Same as Fig. 1, but pruned ready for planting.

central trunk or leader, if possible. A branch near the center of the tree should be selected for the leader and kept in the ascendency by pruning all other branches that tend to outgrow it. If forks occur in this leader, one side of the fork should be severely cut back in order that the other side may be retained as the leader. Trees growing in this way are not likely to split down when heavily loaded with fruit.

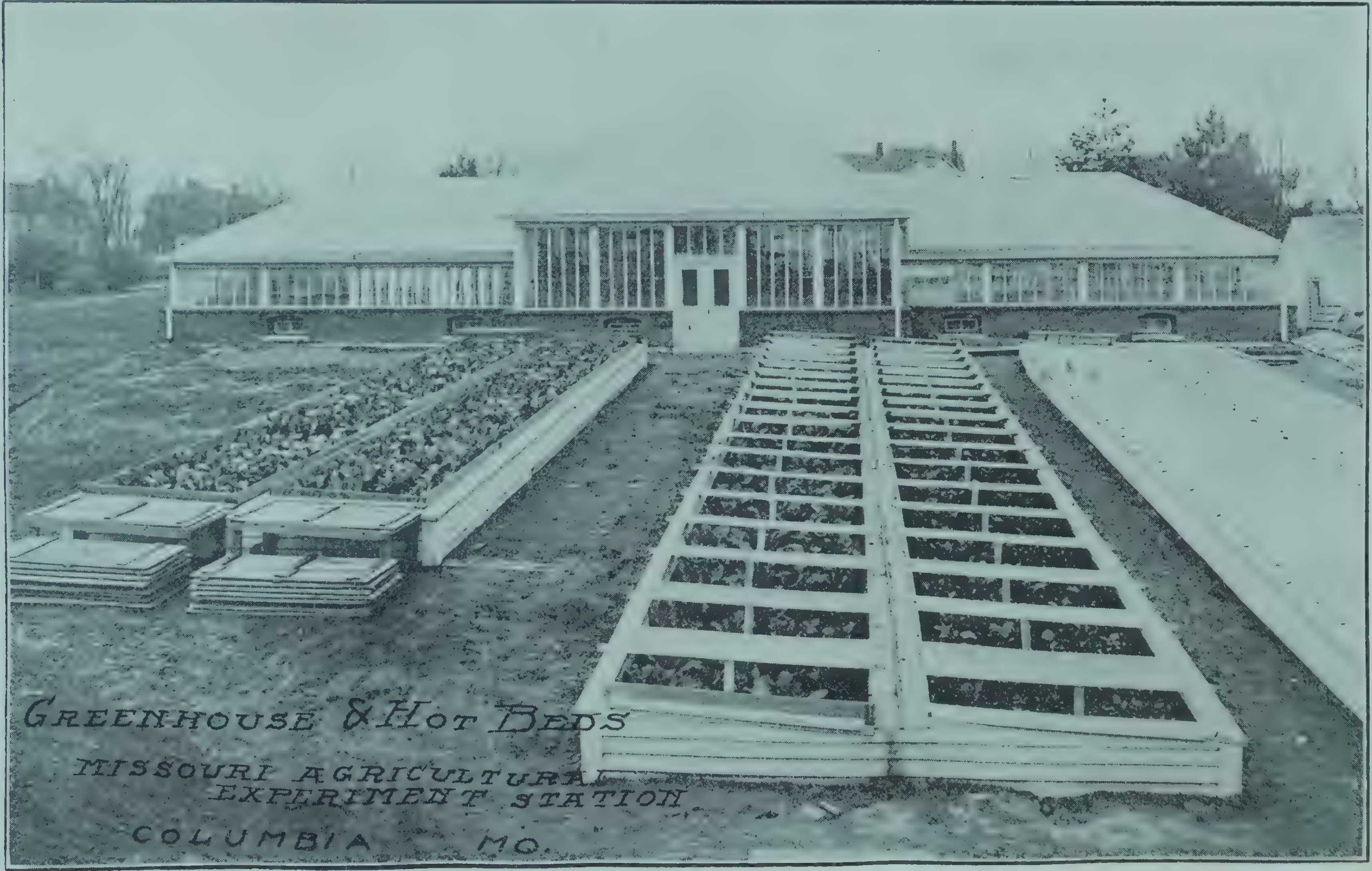
The symmetry of the tree should be maintained by cutting back any branches that grow too far to one side. If branches grow to each other, and rub severely enough to cause injury, one should be cut out to avoid interference. If branches are numerous enough to crowd each other severely some may be removed. There is more danger of opening up holes in the head of the trees and letting in too much sunlight to scorch the trunk and main limbs than there is of leaving the branches too thick. Where the upright growing limbs of young trees appear to be very dense they will usually be weighted down by the first heavy crop of fruit sufficiently to open up the head of the tree. Whenever there is doubt as to whether a branch should be removed, it is perhaps safer to leave than to remove it. Water sprouts, which are the bane of some fruit growers' existence, will not usually form in trees if the tree head is maintained in this way. Water sprouts are oftener an indication of too much pruning than too little.

It may be observed in almost any orchard in this section of the country, that the branches on the north side of the trees tend to outgrow those on the south side. The influence of the sun and hot winds from the south and southwest seem to be too strong for the best development of the branches. The trunk and main limbs often suffer from these causes. This uneven growth in the sides of the tree is more marked in some varieties than in others, but is more or less observable in all. It will be understood from this, that the pruning may be more severe on the north side than on the south side of the trees. It is frequently advisable to shorten the northern branches somewhat. In removing surplus branches, it is often safe to cut one from the north side, when a similar branch should not be removed from the south side. Particular care should be taken to encourage the maximum growth of southern branches, while the northern may be cut more severely without damage. In this connection some growers advocate setting a tree so that it will lean toward the southwest. This plan is finding few advocates during recent years, as the branches of the tree grow in the same direction, even though the trunk leans, and this results in an upright head on an inclined trunk, which is undesirable.

The above caution against thinning the limbs too much should not be construed to mean that apple trees should not be pruned. The orchard should be gone over each year and all trees pruned that require it. A surplus branch should be removed while it is young, so that the wounds will be as small as possible. A little pruning each year is better than to allow the trees to go without pruning for several seasons, and then remove a great deal of wood all at once. If a neglected orchard is to be pruned, the surplus branches should not be removed all at one time, as this may let in too much sunlight on the limbs or trunks that are accustomed to shade.

Cultivation.—Apple trees should be given clean culture, the same as corn or other hoed crops. It is well to begin cultivation early in the spring to air out the ground, stimulate early root growth and let the spring rains down into the subsoil, where the water may be stored for use during the hot, dry months of summer. It is a mistake to allow the land to lie hard and crusty in spring simply because weeds are not growing, and in this way allow the washing off of the rains over the surface when they should be stored in the subsoil below. In most cases the soil may be turned with a plow, but in some cases it is desirable to use a cutaway harrow, disc or other tool. The latter cultivation should be shallow, so as not to dry out the soil too deep during summer. A crust should not be allowed to form on the ground, but a loose dust mulch maintained on the surface. This is the best kind of surface mulch to retain the moisture in the soil. Cultivation should cease early enough for the wood to ripen for winter. The exact time varies according to conditions. If the trees are carrying a heavy crop of fruit, or if the autumn is dry, the ground should be kept in good tilth until September. If the season is favorable for the late growth of the trees, cultivation may cease in July. Sometimes a drought in July or August will cause uncultivated trees to shed their leaves and almost become dormant in late summer, and then burst into almost spring-like growth when autumn rains come. This autumn growth should be avoided by giving the best cultivation during any mid-summer drought that may occur so that the trees will not cease growth until the normal time in autumn.

While clean culture during a part of the season is highly desirable, it is not advisable to allow the orchard to go very many



GREENHOUSE & HOT BEDS
MISSOURI AGRICULTURAL
EXPERIMENT STATION
COLUMBIA MO.

Figure 1. Greenhouses and hotbeds, Missouri Agricultural Experiment Station, Columbia, Missouri.

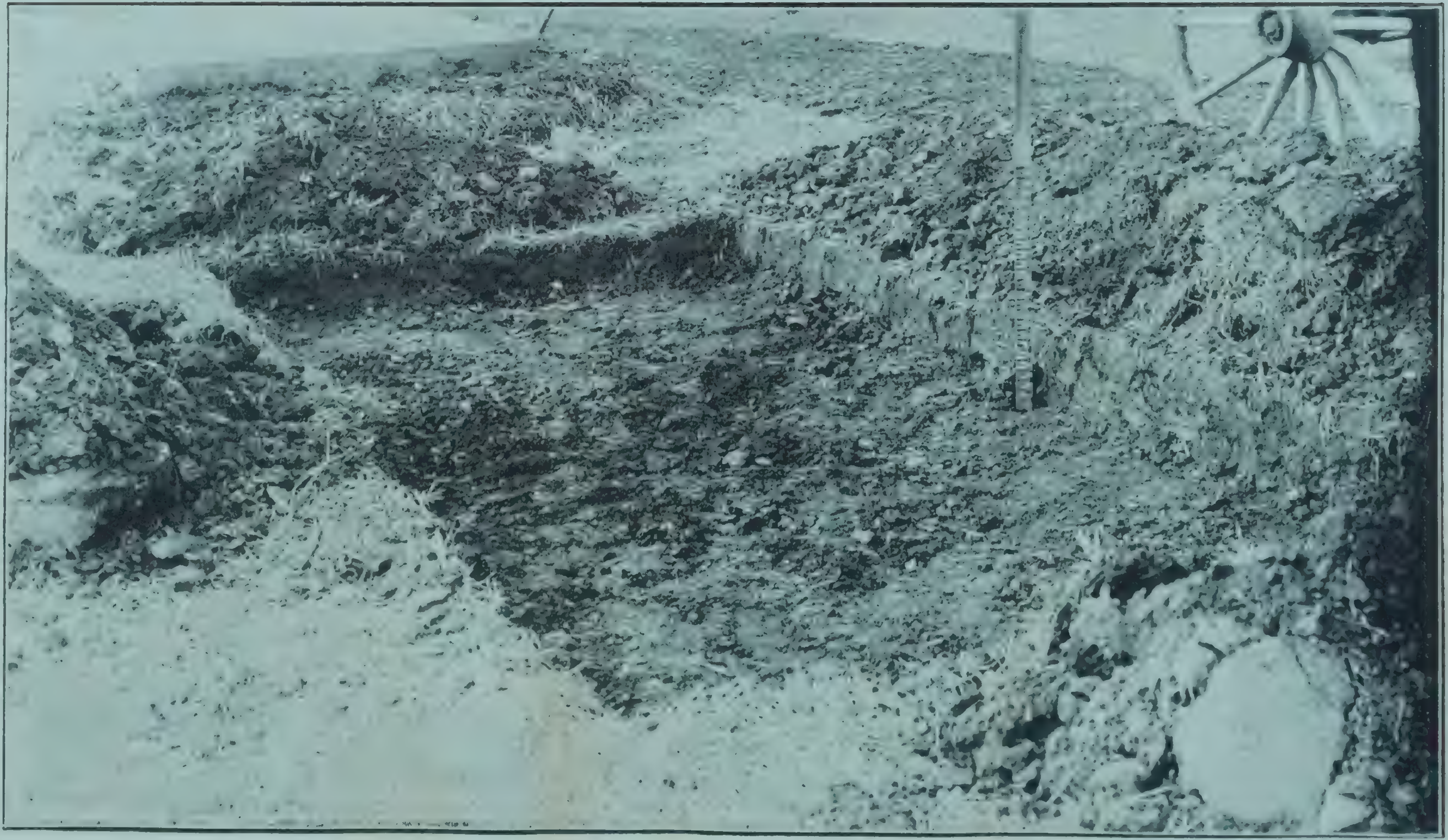


Figure 2. The first step in making a hotbed. Pit 6x12 feet in size (for three sashes), excavated to a depth of 6-10 inches.

years without plowing in some kind of plant growth to prevent the land from losing humus. In young orchards it is also often desirable to grow some kind of crop between the trees to help pay for their cultivation until they come into bearing.

Crops of almost any kind that can be cultivated, may be grown between the trees. Corn is a good crop for large orchards on rich soil, for the corn can be managed in large areas. Small fruits or garden vegetables are suitable for small orchards. One should never sow grain or a crop that cannot be cultivated for at least part of the season in the orchard. Cowpeas is one of the best orchard crops for this State, especially on thin soils. If they are sown in drills and cultivated for a time, it is better for the trees, but cowpeas sown broadcast in June, after the orchard has been well cultivated in spring, are better than most other crops, even though the other crops are given continuous culture. Cowpeas or soy beans are an excellent crop to plant in drills next to the trees when the corn is planted in the middle between the rows. Two rows of peas next to the trees and four rows of corn in the center make a good planting. If fed to hogs, this affords a mixed ration which is said to be superior to one kind of feed alone.

Diseases.—It may be briefly stated that apple trees should be sprayed with the Bordeaux mixture just before the buds burst in spring; just before the flowers open; as soon as the blossoms are gone; and twice at intervals of ten to fourteen days subsequently. This will do away with most of the scab and skin blotch and other fungous diseases. The Bordeaux mixture is made by combining four pounds of lime and four pounds of copper sulphate with fifty gallons of water. The lime should be slacked and mixed with 25 gallons of water. The copper sulphate should be dissolved by suspending it in a sack so it will just touch water in a tub. The four pounds of copper sulphate should be mixed with 25 gallons of water and then poured into 25 gallons of lime water. This mixture should be strained through excelsior, clean straw, or other strainer, so it will not clog the nozzle, and it will then be ready for use.

To simplify the work, copper sulphate may be dissolved (say one pound to each gallon of water), and four gallons of this solution may be used for each 50 gallons of the Bordeaux mixture. The lime also may be slacked in large quantities and the equivalent of four pounds of dry lime used for each 50 gallons. The lime water and copper sulphate solution should not be put together until they are to be used. It should also be remembered that they should not be mixed too strong, but that half of the water should be added to each before mixing. For canker worm, codling moth, and other biting insects, five ounces of Paris green or London purple, or some equivalent arsenical poison may be added to each 50 gallons of Bordeaux mixture at the time these insects appear. For borers the trunks of the trees may be wrapped with papers, cornstalks, mosquito netting, or wooden veneer wrapper. These wrappers also keep off rabbits, and protect the trunks of the trees from sunscald. It is fair to state that some growers have reported injurious results from the use of wooden wrappers. We have used them for years on some of the trees of the Station orchard, and have seen them used in many of the largest orchards in the State, and have observed no injurious effects from their use where they have been kept loose on the trees so as not to allow them to prevent proper growth.

Picking and Packing.—The time to pick apples depends upon the variety and the character of the season. Apples which are picked early usually keep better than those which are picked late. Early picked fruit has a tendency to shrivel and become tough from loss of moisture. It also lacks color.

If allowed to remain on the trees longer, the apples take on a better color, but are more liable to rot in storage. It should be borne in mind, however, that if apples are picked moderately early, they will continue to color up after being gathered. It is usually best to pick them as early as possible without their being liable to shrivel after the picking, even though their best color has not been reached. For general storage the mistake of picking too late more frequently occurs than that of picking too early. If apples are to be stored in an ordinary cellar, they should be picked earlier than if they are to be put in cold storage, for the reason that in the cellar the breaking-down process of the fruit goes on much more rapidly during winter than it does in the low temperature of cold storage buildings.

Certain varieties should be picked earlier than others. Generally speaking, those which ripen earliest should be gathered first, and the latest keepers should be the last to be taken from the trees. The Jonathan, for instance, usually should be picked a month earlier than the Ben Davis. The Jonathan and York should be picked before they have reached their full color, which is usually some time in September. Grimes Golden should be picked when the earliest specimens begin to assume a yellow color and when their seeds begin to turn black. Ben Davis and Gano are usually gathered in October, when they have taken on good color, and the later keepers, like Ingram, Genet, Winesap and Clayton, may be allowed to remain on the trees even a little later.

In gathering apples they should be handled so as to receive as few bruises as possible. They should never be shaken or knocked from the trees, but picked singly in the hand, placed in a one-half bushel basket, well padded with burlap, and handled as little as possible before they are finally put into barrels or boxes. Every apple should be picked with the stem on. It is as much a part of the apple as the skin itself. Pulling out the stem leaves a wound in the cavity of the apple, where bacteria and germs of decay find a convenient breeding place. Not only should all bruises of the skin be avoided, but the natural waxy color of the apple should, so far as possible, be retained intact.

A cool place in an open shed or the shade of trees should be selected for packing. Apples should be cooled as much as possible before they are put in the barrels. If barreled up and put in storage hot they are very liable to decay badly before the mass becomes cool through.

In barreling, two layers of apples should be placed with stems toward the head in the bottom of the barrel, the last apple in each layer being of such size as to wedge the layer tight. Other apples may then be carefully put in. The apples should be frequently shaken down into place by lifting the barrel up and down and shaking it sideways, so that during the filling process the fruit will be packed as tight as possible. When the barrel is nearly full, two more layers of headers should be placed in so the last layer will stand about one inch above the chine of the barrel. The clamp should then be adjusted and the head pressed down into place to retain the fruit tight in the barrel. If fruit is loosely packed so that it will move about during shipment or handling, the apples become bruised and rot badly. After filling, the barrels should be placed where they will cool off as quickly and thoroughly as possible, and never be piled in large masses during hot days.

Ordinarily two or three grades of apples are made. In some cases the very finest specimens are selected, double wrapped in tissue paper and packed in bushel boxes or barrels to catch the highest prices in the market. In places where Jonathan, Grimes Golden and York are grown, it is highly desirable to pack the select portion of the product into boxes and put in cold storage and sell for high prices in late winter or early spring.

The majority of apples, however, should be sorted into first and second grades and barreled. Those which are not suitable for packing may go into the evaporator.

In barreling apples the packing should be uniform throughout. It is a mistake to put fine fruit in the ends of the barrel and fill up the center with culls. Only sound specimens should be barreled, one soft or rotten fruit often being capable of causing nearly the entire barrel to decay.

HOTBEDS AND COLD FRAMES—THEIR PREPARATION AND MANAGEMENT.

(By W. L. Howard, Professor of Horticulture, University of Missouri. Reprinted by permission of the Fruit Grower of St. Joseph, Mo.)

A hotbed is a device for furnishing bottom heat from fermenting manure, for the purpose of growing plants out of their natural season or for forcing them into quick growth. If course, there are hotbeds, heated by steam, by hot water, and in other ways, but these will not be considered here. A hotbed adapted to the needs of the farmer or city man is simple of construction, and can be made complete, at a cost of only a few dollars.

While it is possible to make a hotbed in October, sow the seed, and have young plants like lettuce large enough for transplanting by December, and then make up a new bed in which they are to be grown to maturity; it would be much better in most cases to use the ordinary hotbed for growing such crops as lettuce, radishes, cauliflower, etc., beginning about the first of March. The hotbed is especially useful for starting many plants in very early spring, expecting to transplant them to the field when the weather is warm and settled. Another use to which a hotbed might be profitably put is the growing of violets. For this crop no bottom heat is needed, and hence these plants should be grown after the bed has been used for forcing purposes.

It is just as easy and costs not a great deal more to have a "range" of three frames instead of one. This arrangement makes it possible to grow different kinds of crops under different conditions. The following description, supplemented by the photographs, will enable anyone to make a hotbed.

The best location for a hotbed is on the south side of a building or high board fence. It would also be better if the ground slopes toward the south. Under these conditions the fullest amount of sunlight will be secured. As will be seen in the figures, this description is for a range consisting of three sashes. The size of each sash is 4x6 feet, hence the space to be staked off would be 6x12 feet. For Missouri conditions excavate to a depth of from 6 to 10 inches, throwing the earth out on all sides. Next prepare the framework for the bed, which is made of pine boards 12 inches wide. In the corners are nailed pieces of 2x4 pine, which serve not only as braces for the frame but as legs for it to rest upon. These, of course, should be long enough to reach to the bottom of the pit, but allowing the framework itself to be level with the ground. Two 2x4 pieces should be fitted across the frame to correspond to the widths of the sashes, that is, the first piece should be 4 feet from the end and the other one half way between this and the other end. If the ground slopes four or five inches in six feet, the beds, when finished, will have about the proper slope, but if this is not the case, two of the legs of the frame (those on the north side) should be a few inches longer than the other two.

After the frame is fitted into place, the earth should be banked around it. One load of fresh manure will be sufficient to make up the range. The best material for this purpose is that secured direct from the stable, the material itself consisting largely of the bedding from the stalls. Material which has been exposed to the weather for a time is worthless, as it will not heat. The manure is thrown into the pit, distributed evenly over the space and tramped down firmly by having a man constantly walking over it. After being filled to the top of the pit, and perhaps a couple of inches higher, the whole is nicely leveled. It is then necessary to water the bed thoroughly. Emphasis should be laid on this part of the work, as it is necessary that the manure be thoroughly soaked before the proper fermentation will take place.

A layer of rich, porous soil, about 2 or three inches thick, should be spread over the manure. After a hotbed has been in use for a year or two, the old manure, which has previously furnished the heat, but which has now thoroughly decayed, makes a most splendid soil when thoroughly mixed with the dirt that is upon it. In the absence of this, however, good soil may be prepared by using equal parts of garden loam and thoroughly rotted manure and mixing with the mass enough sand so that the particles can be seen throughout when handling it. Two or three shovelsful should be sufficient. The bed is now complete and ready for the sashes to be placed upon it.

This form of bed is a compromise between the old fashioned regular form with a pit 18 inches deep and the kind which is made wholly above ground, no excavation being employed at all. This raised kind is, of course, a temporary bed, but it often serves a useful purpose for growing early spring crops and can indeed be used throughout severely cold weather by heaping manure around the outside.

The following details show the various items of expense in making a hotbed:

Three sashes (without glass), at $1.00 each	$3 00
One box glass, size 8x12 inches	3 00
Paint for sashes	1 00
Glazing points	05
Putty	15
Three pieces pine lumber 1x12x12, two pieces pine lumber 2x4x12	1 30
Time of one man glazing and making frames, 10 hours	1 50
Time of one man hauling manure, digging pit, preparing frame for use, 10 hours	1 50
Total	$11 50

Of course, if a man can do all of the work himself, three dollars may be subtracted from this amount. If only one frame is desired, it could be made at a cost of a little more than one-third of the three here described. The items for labor, the cost of manure and hauling the same, of course, will vary under different conditions, but these things may be easily estimated by anyone interested.

The figures given are for sashes or frames, 4x6 feet in size, which size is largely employed, but for the amateur, it is recommended that smaller ones be used, say 3x6 feet. Sashes of this size are made in large numbers and kept in stock by some of the big manufacturing companies, and are quoted as low as $1.60 each, complete with glass.

If the frames are to be used during cold weather and are expected to be kept for a number of years, it will pay to make covers for each of the sashes out of good pine lumber one inch thick. There are on the market specially prepared mats or rugs for covering hotbed sashes. A cheaper way than either, which is quite effective in severely cold weather, is to cover the sashes over with fresh manure to a depth of six inches. Beds treated in this way come safely through a temperature of 20 degrees below zero.

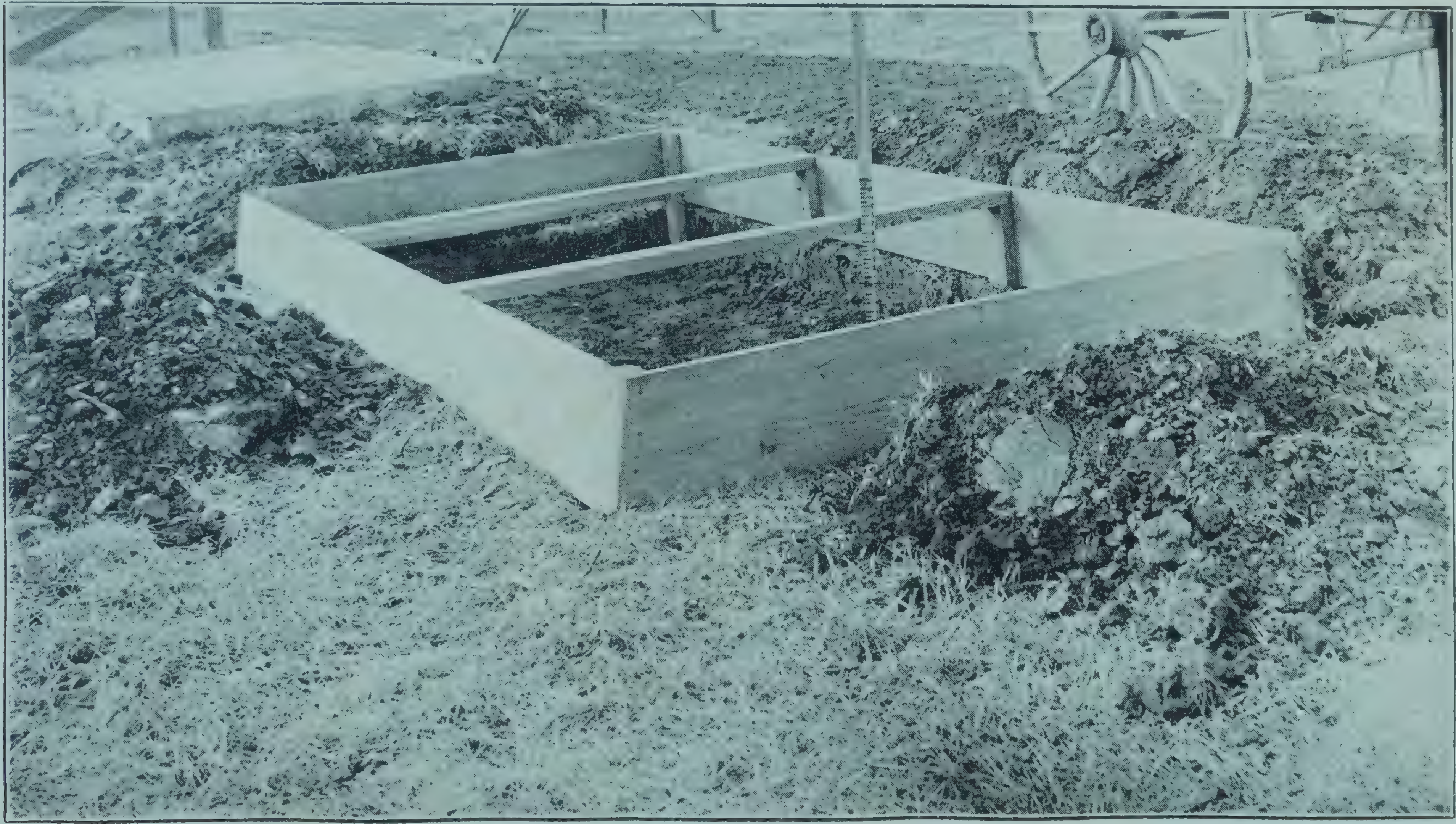


Figure 3. A "range" of three frames or sashes for the earth to be banked around the outside.

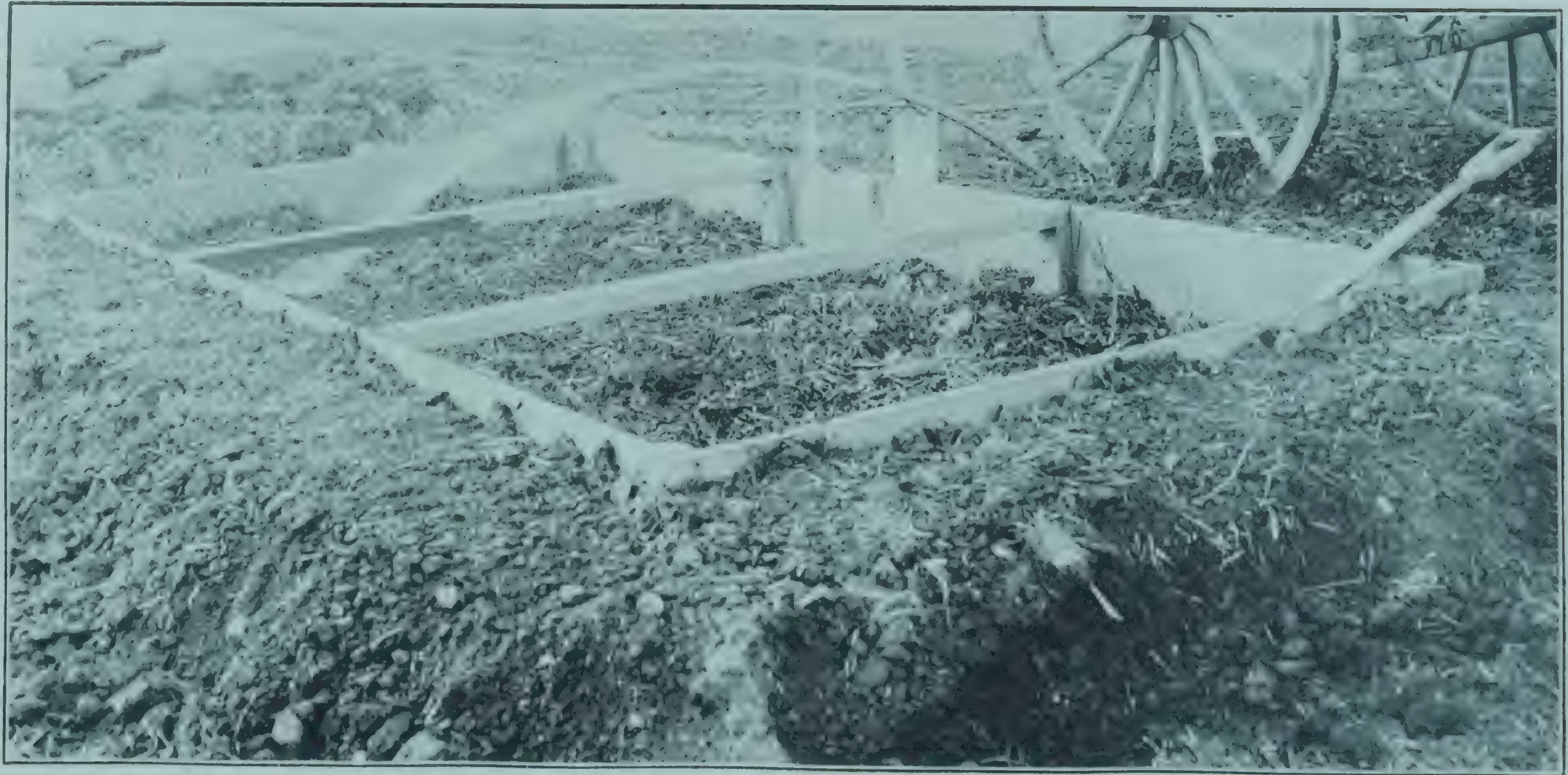


Figure 4. Earth banked around framework and the pit filled with fresh stable manure. The manure must be wet down thoroughly.

USES OF HOTBEDS AND COLD FRAMES.

Every person who raises garden truck should make use of glass in his work. It costs so little to equip a hotbed or cold frame that these conveniences are within the reach of all. They are easy of construction and not as troublesome as many seem to think. While their management is not a formidable matter, it should be stated that the highest success in growing some of the hotbed crops can only come after much practice. Still the beginner can acomplish a great deal the first year and the satisfaction that follows having produced fresh vegetables out of season or beautiful flowers earlier than would otherwise be possible, is ample pay for the time and thought that have been expended upon the work, to say nothing of the money value of the things produced. Furthermore, there are certain crops, such as celery, cauliflower, sweet potatoes, etc., the successful growing of which at all times demands that they be started under glass. Finally, the work is exceedingly interesting and will, for many people, furnish a pleasant and healthful diversion from their regular duties.

At the outset, it should be distinctly understood that the term "hotbed" has different meanings, depending upon the part of the country where it is used. For instance, at the north a hotbed is pretty generally understood to mean a pit from thirty to forty inches deep, while in the latitude of Missouri, it might have reference to a pit only eight or ten inches deep, but usually, for permanent use, from 18 to 30 inches deep, and in the far South, simply a mass of fermenting manure enclosed by a frame, but wholly above ground. Again, hotbeds may consist of long, double ranges built of wood or brick and of varying depths; where the heat from the fermenting manure is supplemented by warmth from steam pipes running around the sides of the bed above ground. See figures 1 and 9.

As here used, it is intended that the discussion shall apply to the commoner forms of hotbeds, in which the heat is supplied by fermenting manure and with pits excavated to such depth as may be necessary to supply the necessary heat for running from one to two months without renewal. At the north, pits will have to be from two and one-half to three and one-half feet deep, while in the latitude of Missouri, twelve to eighteen inches will be sufficient, and farther south even less. For late fall or early spring use, temporary beds almost or wholly above ground, may be made and successfully maintained through unexpected cold snaps by banking up the sides with fresh manure and covering over the sashes with the same material, or with blankets, if desired.

Hotbeds are used for several distinct purposes:

First—For starting from seed such plants as cabbage, cauliflower, sweet potatoes, tomatoes, etc., for transplanting to the open field in spring or early summer.

Second—Growing vegetables out of season, that is, growing them to maturity in the beds. This may occupy all the winter, merely the first part, or only the latter part.

Third—For starting plants from seeds, to be transplanted later to other hotbeds or to the garden. This part of the work may begin in early fall and during mid-winter, when another crop is taken up and carried through until spring, or it may begin in fall and last continuously until warm weather. Under this heading would be included both vegetables and flowering plants.

Fourth—For the rooting of both soft and half-ripened wood cuttings, as roses, geranium, abutilon, lantana, etc.

Fifth—For the growing of many plants which require little or no heat. This would not be a hotbed in the full sense of the word, but a cold frame. However, no sharp line can be drawn between the two, as the hotbed that has almost lost its heat is made use of for certain plants, with the expectation that they will be continued in it after the heat is entirely gone. The cold frame is, in fact, almost as useful as the hotbed, but the two must be employed together, as both are necessary.

PLANTING AND MANAGEMENT.

To take up the various crops grown in hotbeds and discuss in detail their management would require pages of space. A few general hints, however, may be given which may be helpful to the beginner. The principal vegetables grown to maturity in hotbeds are lettuce, radishes and cauliflower, although such things as egg plant, melons, cucumbers, and many others are grown to maturity. The beginner should start with lettuce and radishes and perhaps cauliflower. Start a mild hotbed not later than the middle of October for the latitude of Missouri. When the temperature has come down to about 65 F. the lettuce seed may be sown in flats. These are shallow boxes 12x18 inches in size, and 2 to 4 inches deep. The soil should be rich, fine, and contain enough compost and sand to prevent it from baking, and at the same time furnish good drainage. Germination may be greatly hastened by soaking

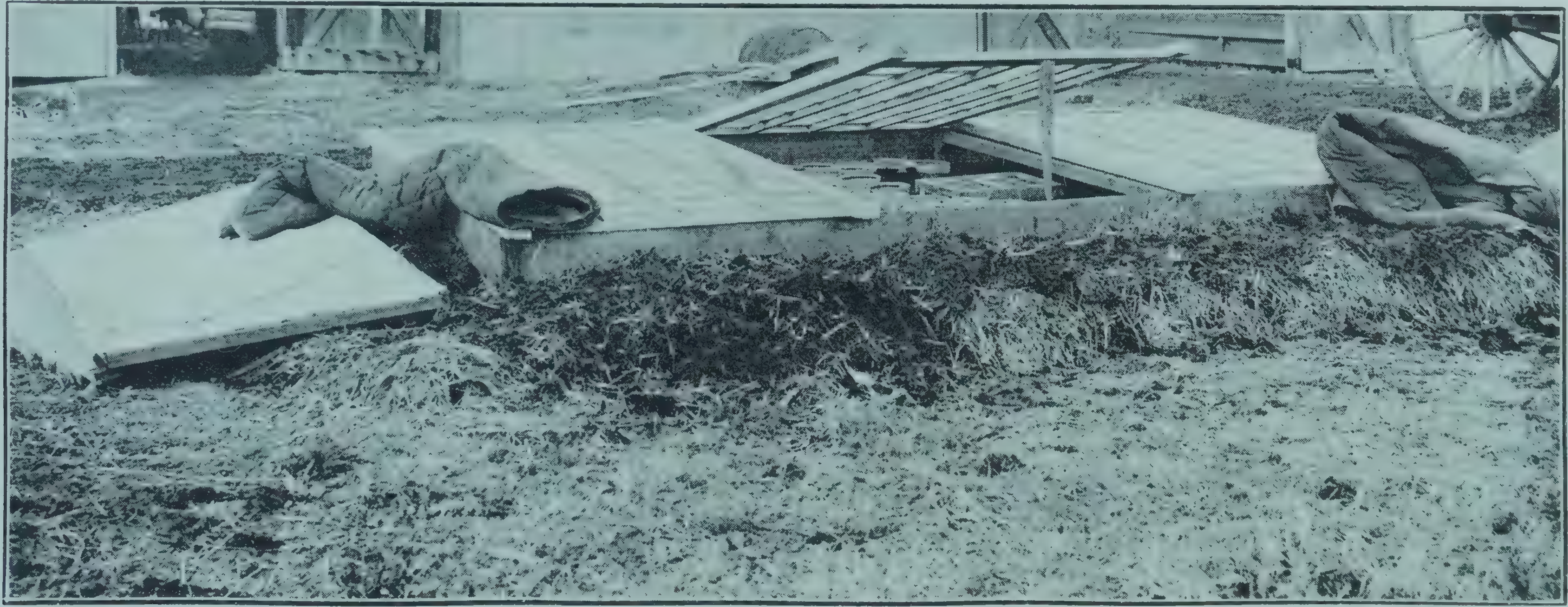


Figure 5. The finished hotbed containing growing plants. At the left are shown a mat used for protecting frames during severely cold weather, and some cloth sashes, used instead of glass in late spring.

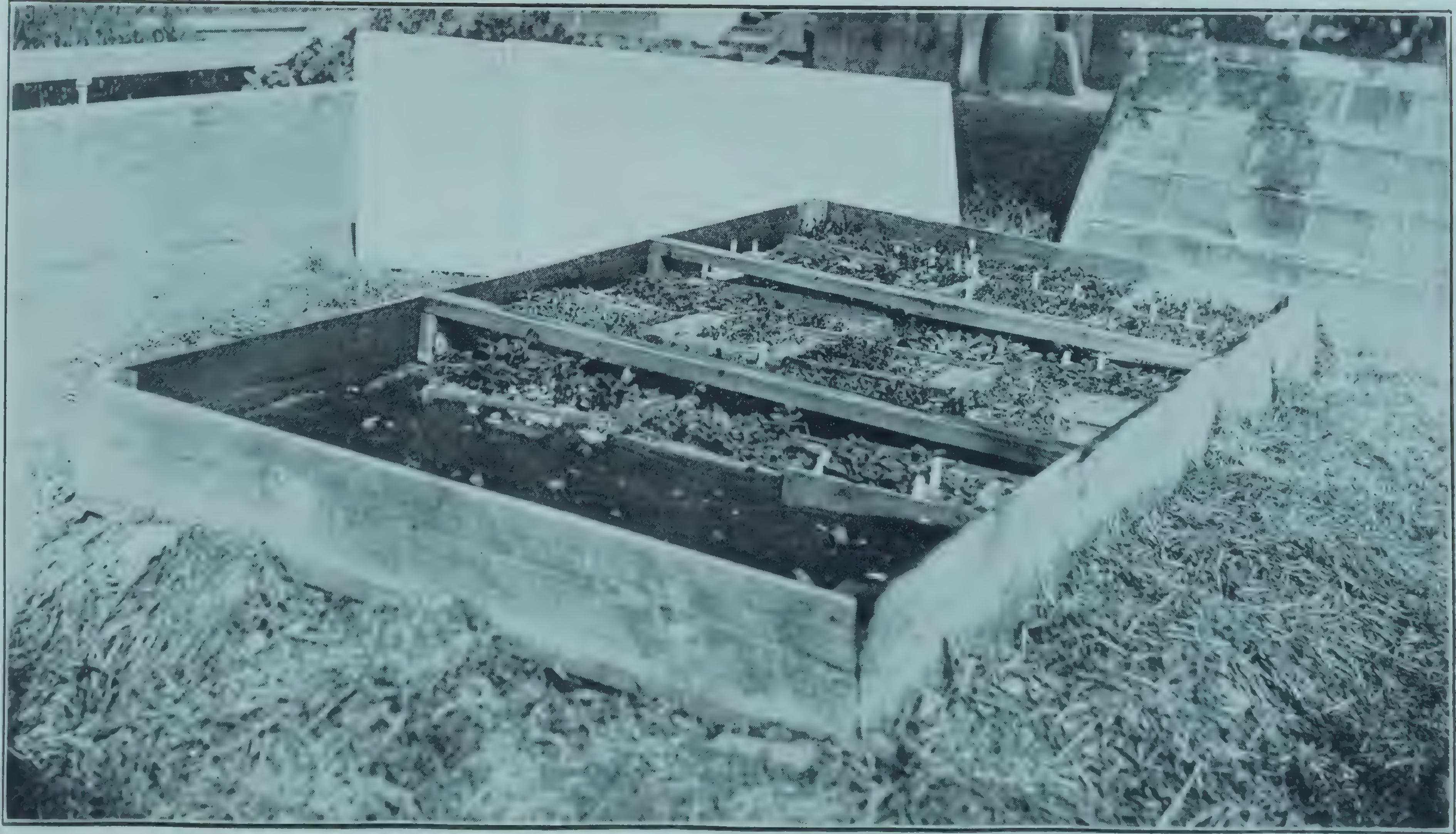


Figure 6. An inexpensive 3-sash range of hotbeds for spring use.

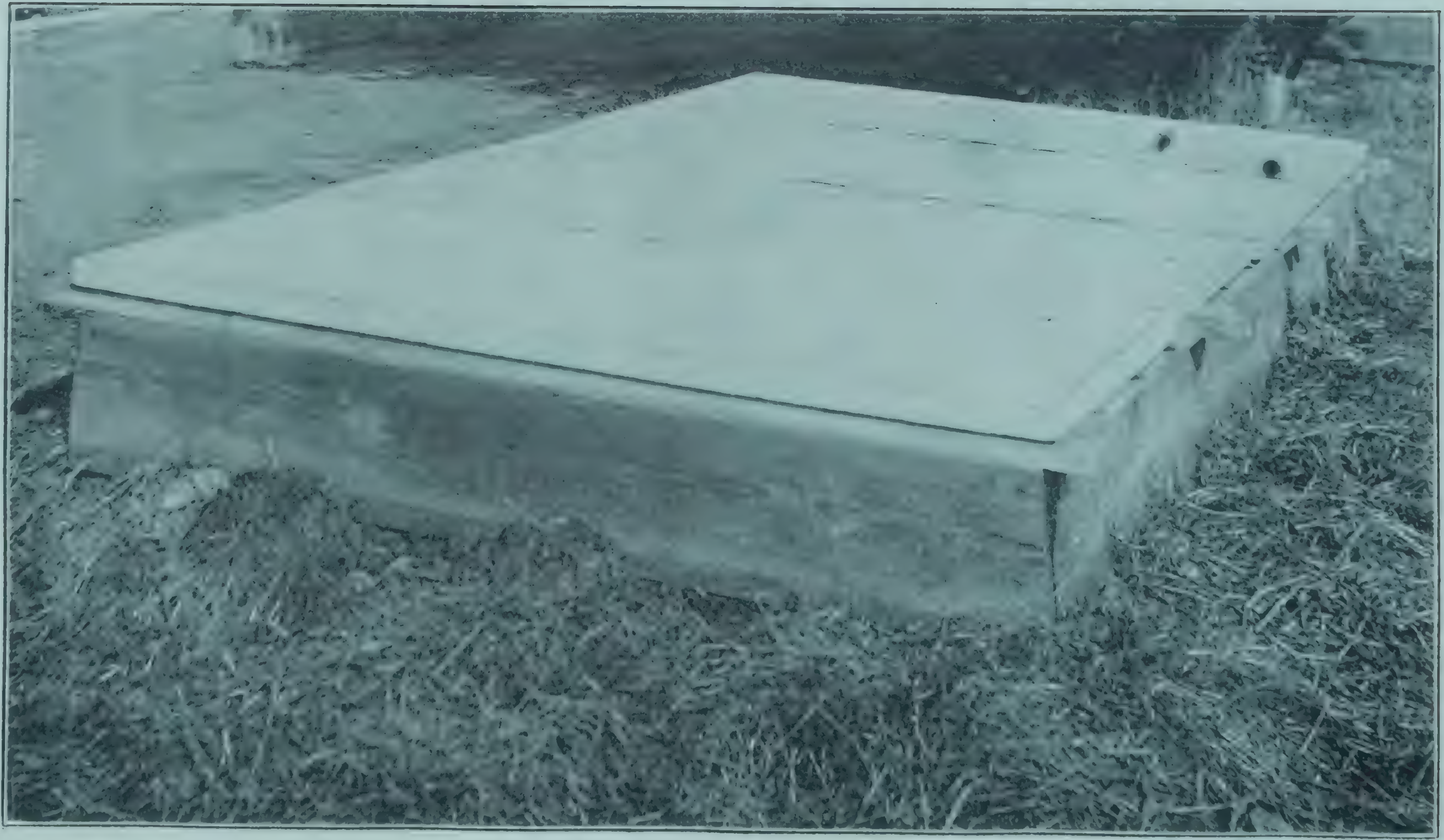


Figure 7. Same as Fig. 6, covered with both glass and cloth sashes, the latter being used for shading.

the seed before planting in lukewarm water for from twelve to twenty-four hours. This will cause them to come up in four days. Place the flats on the beds and give close attention to the ventilation and watering. The soil in the boxes should be kept moist but never soaking wet. See figure 6. Since the temperature must be kept comparatively low, it will be necessary to ventilate during the day when the sun is shining, by raising the sashes from two to six or eight inches, and propping them up with blocks. See figure 8. Of nights the bed should be protected according to the weather. If below freezing, it would be well to cover the sashes with boards or mats. After the seedlings have grown two leaves, they should be transplanted to other flats, setting them one inch apart each way. Here they are grown until they have formed three or four leaves or until they are crowding each other, when they are to be transplanted to a fresh hotbed, which has been prepared to receive them, where they are set 8x8 inches apart. This distance is necessary for head lettuce. Immediately after setting out the lettuce, a row of radish seed may be sown in the spaces between the lettuce rows. This will be in early November, and in four weeks, if all goes well, the radishes should be large enough for table use, and the lettuce should be ready by Christmas. The best varieties of lettuce for forcing are St. Louis Butter and Big Boston. Radishes—Early Scarlet Globe and White Tip. In figure 10 are shown several varieties of head lettuce grown in a hotbed in winter.

When the lettuce has been harvested, which will be early in January, clear the ground, smooth the soil, and sow lettuce seed broadcast, mixing in a sprinkling of radish seed. Keep the bed cool, and about the middle of February the seedlings may be transplanted to a new frame. The old one that they came out of may be renewed for this purpose, as the radishes will have been harvested before this. With reasonable attention to watering and ventilation the lettuce should thrive and make a good crop for spring use.

The beginner had perhaps better not try to grow cauliflower the first year. If this vegetable is grown in the hotbeds the plants should have been started a month or so previously. The cauliflower should be set out first, setting the plants about eighteen inches apart each way, and with two rows of lettuce in between. Radishes may be sown between the lettuce rows. Both the radishes and lettuce will come out long before the cauliflower has matured. The latter will not be ready for use until well along in April.

Since only about eight cauliflower plants can be grown to each 3x6 sash, it may not be profitable in most cases to have the ground occupied so long by this crop. With no cauliflower the beds may be renewed the 15th or 20th of March and used for starting such plants as tomatoes, cabbage, onions, cauliflower and egg plant from the seed, to be transplanted to the open field in spring. See figure 8. Sweet potato plants may also be grown in these beds. It would perhaps be best to sow the tomato seed in shallow flats, as it may be necessary to move them to other frames where it is cooler, if the spring is late and it is seen that the plants will be too large before they can be transplanted. Tomato plants should be low and stocky, and it would not be possible to regulate conditions well where they are grown in the soil in the bed. It would not be so necessary to have the cabbage and cauliflower in boxes.

VENTILATING AND WATERING.

In the management of hotbeds in winter the matter of ventilation and watering should be emphasized. When the beds are very warm the growing lettuce will require a great deal of fresh air. Refer to figure 8. At the same time it must be remembered that under such conditions the plants are very tender and sensitive to cold. A slight chilling, either from ventilating when the air is too cold, or from chilling the plants by watering with water that is too icy will check them and greatly retard growth, if they are not more seriously injured. There are so many sunny days in winter that it will be possible to raise the sashes from one to four inches for at least an hour about noon or a little later every day. The main difficulty will come when the weather is too cold to prop up the sashes at all. Even then they should be raised up high some time during the middle of the day and then quickly lowered again. This may be necessary during cloudy days when the weather is not so cold. This will at least change the air. A need for fresh air is always indicated, at least when it is badly needed, by condensation of the moisture on the glass. When this "sweating" takes place fresh air must be given at all hazards.

The beds will require comparatively little watering. Too much water will drown out the fermenting manure and cause the heat to die out. The soil, however, should never be allowed to be-

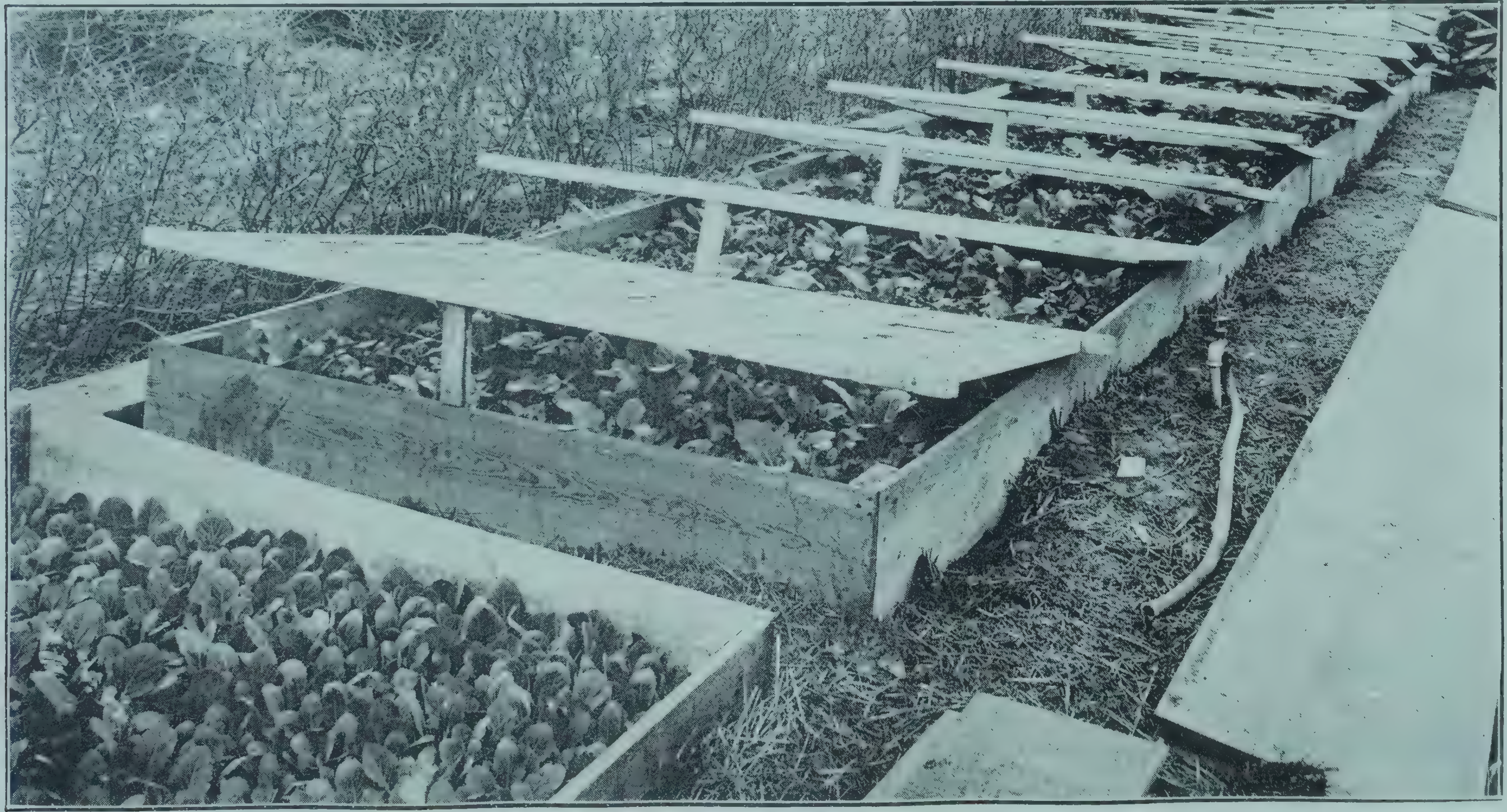


Figure 8. Cabbage and cauliflower plants growing in a coldframe in early spring. Radishes for table use among the other plants.

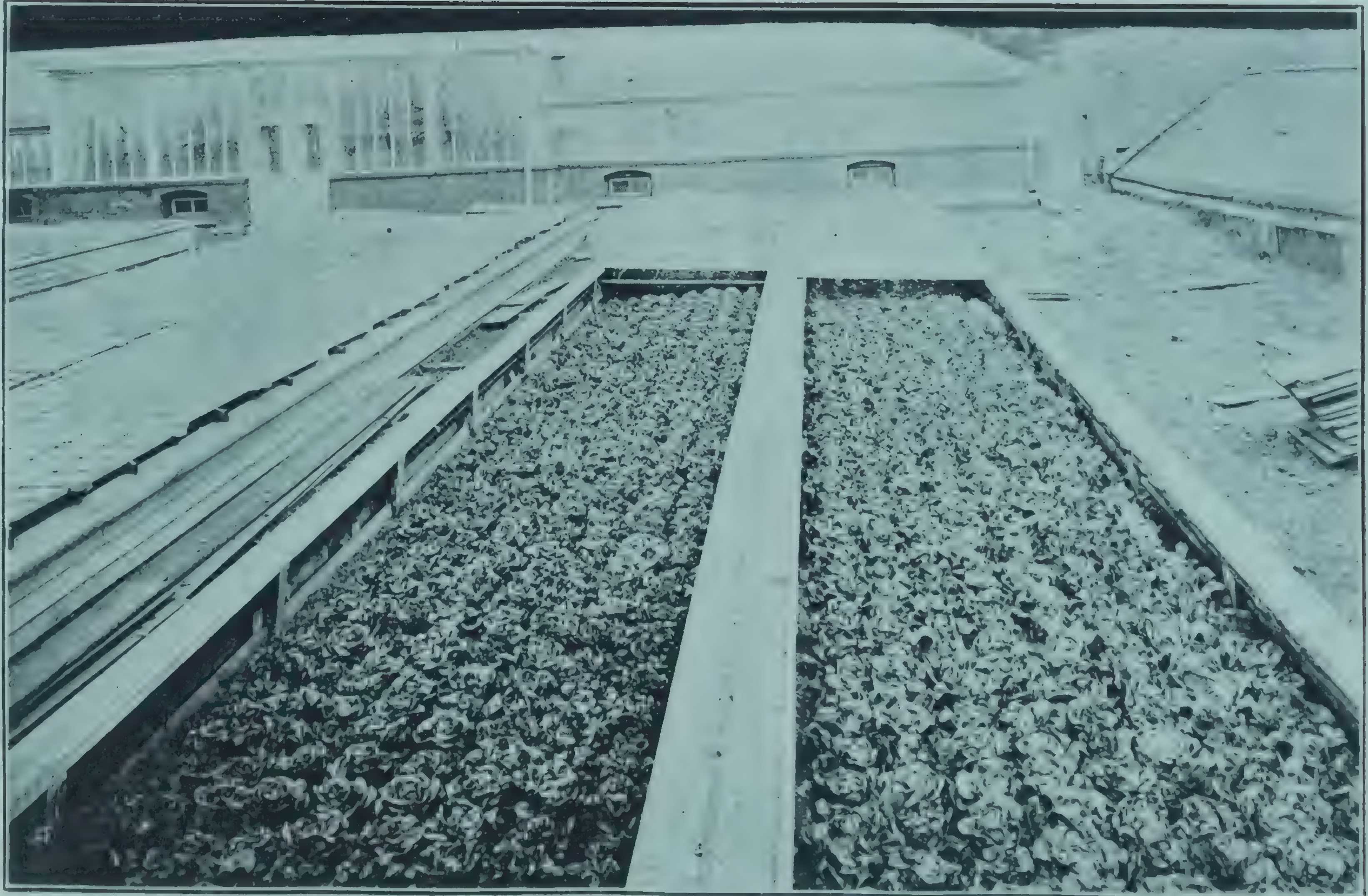


Figure 9. Double range of hotbeds, showing St. Louis butter-head lettuce growing in midwinter.

come dry. The water should be of about the temperature of well or cistern water. Ice cold water would certainly injure the plants. Watering should be done early of mornings when there is prospect of sunny weather. Never water on a cloudy day. When watering is done see that the soil is wet down at least three inches, but not much farther. Moistening the surface only would be very injurious.

SUMMER HOTBED CROPS.

The hotbed space may be used again as soon as the spring crop is out of the way. More lettuce may be grown in the beds without renewing them if there are facilities for watering and shading during the summer. Since there is no heating material to be drowned out, the beds may be soaked down thoroughly when watered. In the pits the heat from the sun will be so intense that there would have to be some protection. Cheesecloth or light domestic, soaked in linseed oil, tacked to a light wooden frame and supported several inches from the ground would make a good shade. Lath screens could also be used. Even brush would help some. Besides lettuce, other warm weather crops, such as egg plant or peppers, could be grown to maturity. A late crop of bush beans could also be produced. Instead of vegetables, flowering plants, like asters, may be successfully grown during the summer. Asters particularly, would furnish cut flowers for a comparatively long period. In mid and late summer, the beds may be used for receiving various kinds of potted house plants needing recuperation. Seed boxes will begin to go in the beds in early fall.

Going back to the middle of the winter, another line of procedure may be followed. When the first lettuce is harvested early in January, celery seed may be sown broadcast without renewing the bed. Under these cold frames, the celery will germinate and grow off very slowly, but the plants cannot be hurried. About the middle of March they should be taken up and replanted on the same ground, setting 4x4 inches apart. They should be caused to make a low, stocky growth and form good root systems. This is brought about only by shearing them two or three times to keep them low. The plants should be transplanted to the field about July 1st.

Perhaps the most important use for hotbeds by farmers would be for growing spring crops of lettuce and radishes and starting tomato and cabbage plants, as well as sweet potatoes. For these purposes the beds need not be started until well along in March. Refer to figure 8.

Another use for hotbeds, or rather cold frames, is the growing of plants from cuttings. The cuttings of geranium and roses and many others may be made in September and October and planted in the cold frame. The rose cuttings should contain at least two eyes. The Crimson Rambler, one of the finest of climbing roses, which is readily propagated in this manner, has its buds usually very close together so that the cuttings containing two eyes would be about two and one-half inches long. Any of the ordinary hardy roses may be propagated from these fall cuttings provided they are made before frost. In the north and northeast the cuttings would perhaps have to be made in August, and in the south perhaps not until as late as November. After becoming rooted, or at least well calloused, it would perhaps be best to pot the cuttings and plunge the pots in the soil. This, however, is not positively necessary. The beds should be kept cold all winter, and they will even stand considerable freezing. In spring the plants should be transferred to the open. For best success the cuttings should be potted off when calloused or beginning to root, and placed in a greenhouse.

Many flowering plants may be successfully grown from the seed in cold frames. The beds should be prepared to receive them in late autumn. Seed may be sown either directly in the beds or in flats. The following may be grown in this way: Pansies, English daisies, snap-dragon, fox-glove, hardy asters, hardy poppies, forget-me-nots, hardy primrose, sweet william, larkspur, lobelia, nasturtium, and others. Keep the soil only slightly moist all winter but give much ventilation. When very cold, cover the sashes with old carpet, hay, etc. The plants can withstand considerable freezing, even down to 10 degrees above zero. In severe weather these cold frames must not be opened. In marked contrast to the hotbeds, they require very little air during cold weather. When it is very cold the beds can go for two weeks without being uncovered.

In March more flowers may be sown in the cold frame. At this time should be sown marigold, verbena, zenias, asters, annual phlox, China pinks, single petunias, sweet alyssum, and other plants which are adapted to transplanting. For a list of these, consult the florists' catalogs. Most all of these, but especially those that were grown all winter, should be set in the garden or flower border as early in spring as the ground will do to work. It should

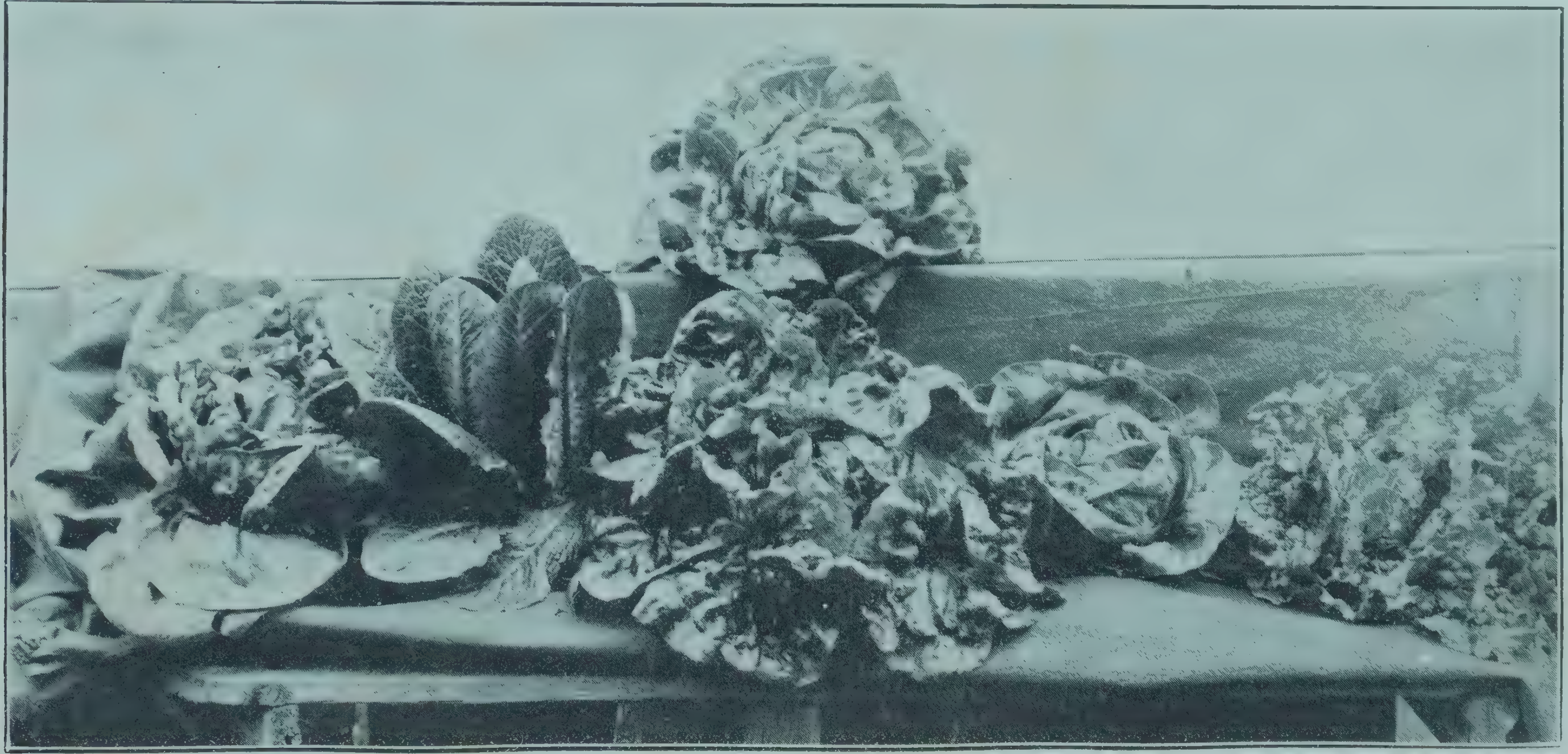


Figure 10. Individual heads of lettuce of the following varieties adapted to forcing: Big Boston, Grand Rapids, St. Louis Butter and Black Seeded Simpson.

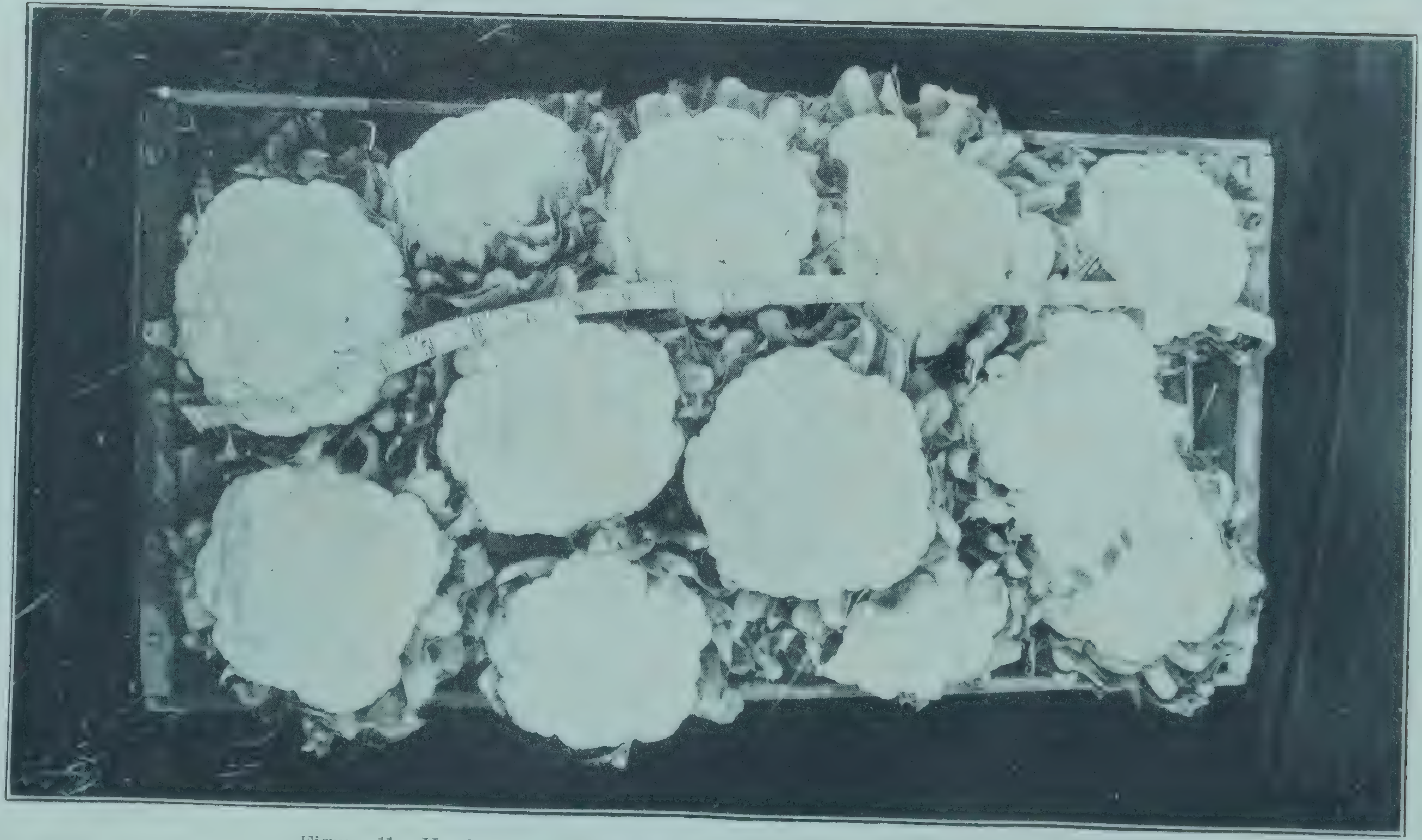


Figure 11. Heads of cauliflower grown in hotbeds—variety, Dwarf Erfurt.

be remembered that the hardy things will not be injured by the late spring frosts.

GROWING VIOLETS.

This discussion should not be closed without a few words on violet growing. With a little practice, sweet violets are easily grown by anyone. Buy violet runners from a floral establishment and plant in the garden in April. Cultivate well all summer and cut off all the runners that form. In late August, in the latitude of Missouri, transplant to the cold frame, setting about ten inches apart each way. The beds should be well watered after planting and occasionally afterward, doing the work well when it is done, and then not watering again until the soil begins to get dry at the surface. The plants will begin to bloom toward the last of October, and continue until the middle of March, provided:

First, that the runners are kept off.

Second—which is even more important—that the temperature in the beds is all the time kept between 35 degrees and 45 degrees F. Under no circumstances should they become warmer than 45 degrees, even though it be necessary to take off all the sashes throughout the day. The temperature may go as low as 28 degrees without injury, but the flowering will be stopped if they get warmer than 45 degrees. The plants must be kept well aired at all times, propping up the sashes daily unless there is danger of freezing. If possible, remove the sashes entirely for a part of each day. Observe figure 9. Violet growing is very profitable when it is understood.

MISSOURI'S TIMBER SUPPLY.

(By W. L. Howard, Professor of Horticulture, University of Missouri.)

The forestry conditions of Missouri are very bad. From a timbered State, we will soon be worse off than a prairie region—worse off because there are large areas unadapted to growing anything else but timber. In every county in the State there are still small areas of trees standing, each farmer usually possessing a few acres of wood lot. Commercially speaking, the majority of Missouri's timber supply has been long confined to the region south of the Missouri river. A few timbers, like the oak, walnut and hickory, are distributed all over the State, but the most valuable timber of all, pine, is confined to a few counties mostly in the southern and southeastern part of the State. In a few sections, as in the southeastern counties, there are timbers not found elsewhere such as the cypress, beech and gums.

The two timbers which have been most persistently sought for are pine and white oak. For many years, a number of lumber companies have been operating in Carter, Wayne, Reynolds, Shannon, Washington and other counties of this region, with the result that the supply of pine is now almost exhausted. To give some idea of the extent of these lumbering operations, it may be stated that I was told that one of these companies had a contract with a man who supplied the logs for the mill, which called for the clearing of every merchantable tree from sixty acres of land per day. This company's mills remained at the same place for several years, and during that time millions of feet of lumber were shipped out. In many instances, after the supply of pine has been exhausted, the companies have turned their attention to the hard woods, viz., the white and black oaks. These oaks, particularly the former, have been the principal source of Missouri's supply of railroad ties. There is scarcely a locality in any of the timbered sections of the Ozarks which has not furnished many railroad ties to their nearest railroad station. In a great many of the southern counties, tie cutting has long been one of the principal industries of the settlers; indeed, many of them purchased the land from the government, or homesteaded it, for the purpose of converting the timber into ties. In a great many instances, these persons, after cutting off all the desirable timber, abandoned their land and allowed it to sell for taxes. All of this land could be reforested with timbers that would grow and become of marketable size in from ten to twenty years. Many people think nothing of making long time investments in mining property and real estate, but would, upon being told that a forest plantation would yield a good return from an investment in twenty years, say that they could not afford to have capital tied up for so long a time. This is the principal argument against planting forest trees, as an investment. It is the farmers, however, who should be interested most in tree planting. The owner of almost every farm depends upon his small area of timber, the woodlot, not only to supply the fuel for the family, but as a source of much convenience in making many necessary articles, as posts, etc., about the farm. Moreover, on most farms there are waste spots which are often wholly unfit for any kind of farming purposes, that would grow forest trees. In the timbered regions of Missouri, the people have always been accustomed to having all the wood they wanted, for all purposes, and hence they have never learned to be economical with it. There have been so many new farms opened up that it has always been something of a problem with the owners how to get rid of the timber that is cut from the land. In many instances, it has been customary to fell the trees in late summer while in full leaf, allow them to lie on the ground until they have become dry and then burn off the mass in one big conflagration. In clearing the farms, the timber is usually considered of no value whatever. With the advent of railroads, this condition has been somewhat improved, as even the roughest of all wood, the black-jack, has come to command fair prices when converted into cord wood, and it is noted for being perhaps the best timber for fuel. Every owner of a farm should begin to plant some forest trees. First, all of the waste places should be planted, and, secondly, a certain portion of the farm should be set apart as a permanent wood lot. If one already possesses one of these useful areas, it should be his aim to plant each year as many trees as he removes. In this way the supply of timber may be made perpetual and yet some of it be utilized each year.

While it would be advisable to plant any kind of tree having a commercial value, there are some that would be more desirable to plant than others. The tree that yields the quickest returns and is yet easy to grow, and in a great many places readily marketed, is the common catalpa. This is one of the principal trees that is grown in the treeless regions of Kansas and Nebraska. The wood is used for fence stakes, posts, telephone and telegraph poles. It is thought that it will also make good railroad ties, but this has not been proven conclusively. On good rich soil it has been proven that where the catalpa has been grown thickly on the ground, say, having the trees about three by three or four feet apart, that a paying quality of wood may be harvested in ten years from planting. It has been shown conclusively that as a long-time investment, say, from fifteen to twenty-five years, growing the catalpa is one which is both sure and satisfactory. The returns begin to come in when the trees are about ten years old, when it will be necessary to thin them out, and after that they continue to become more valuable each year. In one plantation the average for the eighteen years the trees occupied the land, was nearly fifteen dollars clear of all expenses per year per acre. While one may secure fair returns from the poorest land, the catalpa gives a great deal better profits when grown on good soil. In one plantation some very poor land yielded a net return of over five dollars per year per acre, while the best land in the same locality gave a net return of over twenty-six dollars per year per acre.

In growing the catalpa, the secret of success is to plant the trees close together, never farther apart than four by four feet. This will admit of easy cultivation with the plow while the trees are young. If the catalpa tree has plenty of room in which to grow, it will branch out near the ground and will never be useful for even making fence posts. However, if the trees are crowded, in their struggle to secure as much sunlight as possible, the whole mass of trees will grow very tall and any side branches which they may possess will be shaded out and quickly die and drop off. This process of natural pruning takes place very rapidly and the timber is consequently free from knots when it has attained merchantable age.

To the person who intends to plant catalpa, it is best to grow his own plants from the seed. Seeds may be purchased from many of the big seed houses, especially from Meehan & Son of Dreshertown, Pa. The seeds of Catalpa speciosa, which is the common hardy, or western catalpa, retail for about seventy-five cents per pound, but can no doubt be had cheaper in quantities. One pound of seeds would undoubtedly make more than a thousand plants if they all grew. The young seedling trees, one year old, may be purchased for about three dollars per thousand, the purchaser paying the freight. The seeds should be sown in beds and transplanted when they are one or two years old. The following figures may be useful to some readers: If planted two by two feet, 10,890 trees will be required per acre; 2 by three feet, 7,260; 2 by 4 feet, 5,445; 3 by 3 feet, 4,840; 3 by 4 feet, 3,630; 4 by 4 feet, 2,722.

A DISEASE OF NEGLECTED PEACH TREES.

(By F. M. Rolfs, Pathologist, Missouri State Fruit Experiment Station, Mt. Grove.)

Large areas of dead tissue on the trunks and limbs of peach trees are usually spoken of as "sun scald," while the rough, open wounds are known as cankers. This condition has been discussed at various horticulture meetings, but the cause of this trouble has not been fully explained.

Prof. F. C. Stewart of the New York Agricultural Experiment

Station, is the only American who has furnished substantial evidence of the real cause of the trouble. In bulletin 191, on page 318, of the above Station, he says: "Dead peach branches are commonly infested by a species of Cytospora, which is generally believed to be a saprophyte, and considered of little importance; but we have so often seen this fungus intimately associated with dead and dying peach trees, when no other sufficient cause for disease was evident, that we are becoming suspicious that it is, at least, a semi-parasite. Young peach trees found dead in the spring and supposed to have been winter killed, often have the lower part of the trunk thickly covered with pimples; when the outer bark is removed, it is seen that the pimples are caused by the presence of flattened roundish bodies which in color, size and shape, resemble flattened shot. Eventually these bodies become divided into several chambers, each containing multitudes of small crescent shape spores." Experiments conducted during the past three years at the Missouri State Fruit Experiment Station show that the Cytospora referred to by Prof. Stewart, is the imperfect form of Valsa leucostoma. This organism attacks the twigs, limbs and trunks of the peach, plum, apricot, cultivated cherry and wild cherry trees. It has also been observed on the apple and pear trees and on rose and raspberry canes. On the peach tree, infections invariably take place at the buds. If the weather conditions are favorable to its growth, the fungus becomes active during the late winter and early spring months. A period of warm weather which starts the sap, followed by a spell of freezing weather, appear to render the tissue extremely favorable for the development of this fungus. The young twigs, especially water sprouts, are often killed back from two to fifteen inches during the months of January and February. As many as 305 infected twigs have been counted on a single seven-year-old tree during the month of March. Twelve hundred and fifty-two dead twigs, infected with this fungus, have been counted on a six-year-old Elberta tree. Such infections invariably occur on the bearing wood, and must have some influence on the productiveness of the tree.

Elberta twigs, killed during the winter and early spring, at first have a dark, purplish skin, but later the skin on the infected areas becomes leathery and shades into scarlet and purple, giving the twigs a striking appearance. The leathery-colored areas finally change to drab, and the skin on the diseased tissue becomes loose and wrinkled. Black fruiting bodies soon appear below the epidermis on the drab-colored areas. Each of these Cytospora pustules soon push a short, silvery-capped beak through a transverse slit in the epidermis. A single black spot at the center of the silvery caps marks the openings through which the spores are discharged. The entire dead portion of the twig gradually changes to drab in color, and finally becomes dotted with the black silvery-capped pustules.

During damp weather, especially from the first of March until the middle of May, these Cytospora pustules push out fine thread-like bay-colored masses of spores. These spores are soon scattered by the rain and insects. They usually germinate within 24 to 48 hours after they are liberated, and if they are carried to suitable locations, they finally start new points of infection. The diseased portion of the twig gradually dries out and becomes constricted, making the contrast between the dead and living tissue quite marked. Gum pockets often form in the zone between the dead and living tissue.

As soon as the active growth of the trees begin in the spring, the wounds on many of the infected twigs heal, and the advancement of the fungus in such cases is soon checked. However, if the organism becomes thoroughly established, the twig is soon killed down to the branch. In fact, large branches and even limbs may be killed back by it.

During the year 1907, one hundred and thirty-two infected twigs on a seven-year-old Ozark Queen tree were marked, and the advancement of the fungus was carefully recorded on February 16, June 25 and October 18. It was found that the twigs had been killed back on an average of about 3½ inches by February 16; 3 inches from the 16th of February to the 25th of June, and about 4 inches from the 25th of June until the 18th of October. But after the middle of June 68 of the infections failed to advance, so that the average for this period is really about 8 inches.

At the present time, three of the large body limbs are dead and the infections from the limbs have produced a large sun scald area on the trunk.

Various inoculations made on healthy twigs with pure cultures of this fungus during February and March invariably produced the "winter-killed" condition, while the check twigs remained normal.

When infections girdle the branches or limbs during the growing season the foliage gradually takes on a yellow starved appearance, then wilts suddenly and soon takes on a brown, blighted appearance. But the leaves on the twigs and limbs, which are gradually killed back, usually fall soon after the tissue is consumed, consequently they do not attract so much attention.

When the large branches and limbs are infected, especially during dormant periods of the tree, wounds extending up and down on one side of the limb, are often found. As soon as the tree becomes active callus pushes out from the margin of the wound and soon stops the progress of the fungus. The dead tissue of such wounds soon shrivels, dries up and falls away, exposing the wood. If the wound is small, new tissue soon covers the exposed wood. The sides or lips of the newly-formed tissue do not unite firmly for sometime after they meet and leave a slit-like opening through which gum exudes during wet weather. Injuries of this sort often produce slight elevated oval-shaped scars on the limb and branch, and it is nothing unusual to find from 15 to 20 such scars and wounds on old limbs five or six feet long. Cptospora cultures have frequently been obtained from such wounds, by carefully removing the new tissue which covers the wound and placing portions of the discolored wood on potato plugs. This condition has also been produced by inoculating old branches and limbs with pure cultures of the organism. In some of the more aggravated cases, deep, black, cankerous wounds are formed. The limbs, and branches are more or less enlarged at the point of such injury. The dead tissues in these wounds invariably bear a few Cytospora pustules.

Water sprouts are very often severely injured by this organism, but well matured branches which have been weakened from any cause, are often killed back and the fungus finally invades the limbs and trunk, often forming large sun scald areas. However, if the tree is active and in normal condition, the progress of the organism is soon checked. Although its advancement is checked, it may live as a saprophyte on the dead wood and tissue in the moist wounds, and as soon as conditions become favorable, it may again become aggressive. The sudden freezing and thawing of the young shoots renders the tissue more favorable to the growth of this fungus. This is also, in a measure, true of the tissue of the older limbs and the tree trunk.

During the severest weather in winter the feeding threads or hyphae of this fungus, in the diseased tissue, remain dormant. But during the warm spells infections on the trunks and large limbs, which are fully exposed to the sun's rays and sufficiently protected, thaw out. The infected tissue soon becomes warm enough to awaken the feeding threads, which at once take advantage of their opportunity. The dead bark which covers such wounds, protects the active hyphae from the night frosts. Scorching the tissue of the tree also renders it more favorable for the growth of this fungus, and aids it in securing a firm foot-hold. The direct rays of the July sun may also aid the organism in becoming established.

The hyphae of infections which are not well protected and so favorably located in regard to the sun's rays, usually remain dormant until spring. When under normal condition, the tree soon checks their advancement.

The following record of 6,786 trees, taken from three orchards, shows position of the sun-scald areas on the trunks of the trees:

One thousand three hundred seventy-one of the trees contained "sun-scald areas" on the trunks. Sixty-two per cent of these wounds faced the southwest; 14 per cent the south; 11 per cent the west; 4 per cent the east; 4 per cent the northwest; 3 per cent the north; 1 per cent the northeast, and 1 per cent the southeast.

While Valsa leucostoma invariably starts the wounds and plays a prominent part in gradually extending the injury, yet after the wound is once made, various other organisms soon enter the unprotected tissue and aid materially in extending the wound. (*Calospaeria princeps*) is often associated with these wounds.

It is impossible to estimate the amount of damage done by this organism in a single year; but from the nature of the disease it is evident that it shortens the life of many of the trees and aids materially in cutting down the profits of an orchard.

Cultivation, fertilizing, pruning or anything which induces normal wood production assists the trees in warding off this fungus. Trees planted on thin or impoverished soils invariably suffer severely. When the fungus has once become well established, excessive dry weather aids its progress. Sun-scald wounds are often considerably enlarged during the dry fall months.

In some sections of the United States shades built of boards, cornstalks and various other material, are used to protect the trees from the direct rays of the sun. While such protection must have more or less influence on the development of the fungus during the winter months, yet it does not remove the cause of the trouble.

Two applications of the self-boiled lime-sulphur mixture 8-10-50 formula on September 3 and September 16, 1907, reduced the twig infections 20 per cent.

While three fall applications of the same mixture, on August 8, September 3 and September 16, and one application of the standard lime-sulphur wash during the following spring reduced the twig infections 62 per cent.

Two applications of peach Bordeaux mixture during the fall of 1907, the first on September 3, and the second on September 16, reduced the twig infections 20 per cent. Three fall applications of same mixture, the first on August 19, the second on September 3, and the third on September 16, 1907, reduced the infections 69 per cent, and three fall applications of the peach Bordeaux and one spring application of the standard Bordeaux on March 3, 1908, reduced the twig infections 71 per cent.

While the applications of the Bordeaux mixture and the self-boiled lime-sulphur wash materially reduced the twig infections, yet it did not check the enlargement of the cankers or sun-scald areas and consequently cannot be relied upon as a means of controlling this trouble after the organism once becomes established.

In old neglected orchards where the fungus has become thoroughly established, it is practically impossible to get it under complete control, still much good will result from carefully cutting out and burning all dead infected limbs and branches.

In the young orchards, however, this fungus can be successfully controlled, providing the operator is persistent in his efforts. Cut at once and burn all dead twigs, branches and limbs, being careful always to remove infected limbs several inches below any signs of infections. In cutting out the diseased limbs be constantly on the lookout for the cases where the injury extends down the trunk. If the organism has infected considerable tissue on the trunk, especially if the wood is involved, it is almost impossible to save the tree. In most cases, however, the infected wood and bark can be removed beyond the limits of the disease. In cutting out the diseased tissue disinfect the knife and tools as well as the cut surface with corrosive sublimate solution 1 part to a 1,000. Cover all wounds with grafting wax.

THE DEVELOPMENT OF DISEASE-RESISTANT PLANTS.

(By George M. Reed, Assistant Professor of Botany, University of Missouri.)

It is well known that practically all of our commonly cultivated plants suffer severely from various diseases. For the most part, these diseases are caused by bacteria or fungi, organisms relatively simple in their structure and life history, and belonging to the group of the lowest plants.

It frequently happens that practically all individuals of a certain species suffer severely from the attacks of a bacterial or fungous disease. Epidemics of a particular disease occur, due to exceptionally favorable environmental conditions for the organism which is the cause of the injury. Under ordinary conditions, while the causal organism is generally present, very little damage is done. It is only when specially favorable conditions for the bacterium or fungus arise that these epidemics occur.

Many observers have estimated the money loss to agriculturists due to the ravages of fungous and bacterial diseases. In the following table are given a few of these estimates:

ESTIMATED LOSSES DUE TO PLANT DISEASES.

Crop.	Disease.	Region.	Period	Estimated loss.	Authority.
Wheat	Rust—*Puccinia graminis*	Illinois	1885	$1,875,000	Burrill.
Wheat	Rust—*Puccinia graminis*	United States	1891	67,000,000	Galloway.
Wheat	Rust—*Puccinia graminis*	India	1892	1,700,000	Barclay.
Wheat	Rust—*Puccinia graminis*	Australia	1893	50,000,000	Galloway.
Wheat	Rust—*Puccinia graminis*	German Empire	1891	18,000,000	Sorauer.
Wheat	Rust—*Puccinia graminis*	German Empire	1892	1,600,000	Sorauer.
Rye	Rust—*Puccinia graminis*	German Empire	1891	45,000,000	Sorauer.
Rye	Rust—*Puccinia graminis*	German Empire	1892	1,900,000	Sorauer.
Oats	Rust—*Puccinia graminis*	German Empire	1891	41,000,000	Sorauer.
Oats	Rust—*Puccinia graminis*	German Empire	1892	3,000,000	Sorauer.
Oats	Smut—*Ustilago avenae*	Kansas	1888	1,382,328	Kellerman and Swingle.
Oats	Smut—*Ustilago avenae*	Kansas	1889	850,000	Kellerman and Swingle.
Oats	Smut—*Ustilago avenae*	Kansas	1890	911,299	Kellerman and Swingle.
Oats	Smut—*Ustilago avenae*	Indiana	1889	797,526	Arthur.
Oats	Smut—*Ustilago avenae*	Indiana	1890	605,352	Arthur.
Oats	Smut—*Ustilago avenae*	Michigan	1891	800,000	Harwood.
Oats	Smut—*Ustilago avenae*	Michigan	1892	1,000,000	Harwood.
Oats	Smut—*Ustilago avenae*	Wisconsin	1901-'03	13,500,000	Moore.
Potatoes	Late Blight—*Phytophthora infestans*	New York	1904	10,000,000	Stewart.
Apples	Bitter Rot—*Glomerella rufomaculans*	Illinois (four counties)	1900	1,500,000	Burrill.
Apples	Apple Blotch—*Phyllosticta solitaria*	Benton County, Arkansas	1906	950,000	Scott and Rorer.
Cabbage	Black Rot—*Bacillus campestris*	Wisconsin (two counties)	1896	50,000	Russell.
Peaches	Leaf Curl—*Exoascus deformans*	United States	1900	2,335,076	Pierce.
Peaches	Brown Rot—*Sclerotinia fructigena*	Georgia	1900	500,000	Quaintance.
Violets	Leaf Spot—*Alternaria violae*	United States	1900	200,000	Dorsett.

These estimates, of course, are only approximate. Some of the losses indicated may be placed too low, others too high; the fact remains, however, that every year the money loss to farmers, horticulturists, florists, etc., amounts to millions of dollars.

In addition to the estimated money losses, the above tabulation illustrates one or two other interesting facts. The loss of wheat in Germany from rust in 1891 was more than ten times greater than in 1892. The year 1891 was a typical rust year; the environmental conditions, as rainfall, temperature, etc., were very favorable to the development of the rust. The year 1892 was much less favorable to the fungus, and consequently the damage done was very much less. This same fact may be illustrated by another example. Wheat cannot be grown successfully in the coast counties of California* on account of the moisture, which is very favorable to the rust. On the other hand, in some of the interior counties, where the atmosphere is much less humid and the rainfall is less, we find some of the best wheat producing regions of the world. The drier conditions are not favorable for the development of rust, and hence the loss from this cause is inconsiderable.

A particular disease may be very destructive in one region and practically unknown in another. The cultivation of English varieties of gooseberries in this country has had to be given up on account of the attacks of the American gooseberry mildew (*Sphaerotheca mors-uvae* (Schw.) B. & C.) This fungus may be found on many American varieties of gooseberries, but it rarely does any damage, as it for the most part infects the leaves and stems. In the case of the English varieties, however, the berries of which are much larger and more desirable, the fungus is especially harmful in attacking and destroying the fruit, the berries being covered with the persistent felted mycelium. On this account an immense amount of damage is done.

It is interesting, however, to note that this mildew has recently been found in Europe**, probably carried on plants introduced from America. It is doing a tremendous amount of damage to the gooseberry industry in Ireland and England, and efforts are being made to eradicate or control it.

It is one of the problems of the plant pathologist to find means for preventing these enormous annual losses due to diseases. Although the science of plant pathology is still young, enormous strides have been taken towards diminishing these losses. While much has been done, a great deal more remains to be done. The next few years will undoubtedly see great advances made in the control of plant diseases.

---

*Shaw. Bull. 185. Cal. Agr'l. Exp. Stat. 1907.

**Salmon. Zeitschrift fur Pflanzenkrankheiten. 17:12-21. 1907.

Various methods have been employed to do away with, or at least minimize, the losses to cultivated plants caused by bacteria or fungi. One of the earliest methods employed, and also one of the most successful, was to spray the plant with some chemical which would check the growth of the fungus, and yet not be injurious to the plant. Such substances as Bordeaux mixture, copper carbonate, potassium sulphide, etc., have been used. That this method has proved successful may be shown by the fact that such diseases as Peach Curl* (*Exoascus deformans* (Berk.) Fuckel), Bitter Rot of Apples** (*Glomerella rufomaculans* (Berk.) Spauld. & von Schrenk), Apple Blotch*** (*Phyllosticta solitaria* E. & E.), Blackrot of the Grape**** (*Laestadia Bidwellii* V. & R.), etc., may be entirely controlled by the proper application of a fungicide.

A few concrete examples of the efficiency of this method for controlling plant diseases may be given. Selby has found in Ohio that the value of the grapes, per acre, from unsprayed vines was $5.90; the cost of spraying, per acre, was $7.50; the value of the grapes, per acre, from the sprayed vines was $125.21. Scott & Rorer, by proper spraying, were able to decrease the percentage of blotched apples from 84.9-90.3 per cent to 4.9-7.8 per cent. Blair has found that Bordeaux mixture applied at the proper time will save over 90 per cent of the fruit liable to attack by bitter rot.

Another method for doing away with the loss caused by disease is the method of seed treatment.***** This method has been especially successful in connection with the smuts of cereals. The seed may be treated with a solution of formalin for a given time, or it may be soaked in water at a rather high temperature (132°-133° F.) for a few minutes. The formalin or the high temperature kills the smut spores while the grain seed is uninjured. Moore*, in Wisconsin, has been able to decrease the loss from oat smut (*Ustilago avenae* (Pers. Jens.) from 5.5 per cent to .7 per cent by the method of treatment with formalin.

---

*Pierce. Bull. 20. Division of Vegetable Physiology and Pathology, U. S. Dept. of Agric. 1900.

**Blair. Bull. 117. Illinois Agr'l. Exp. Stat. 1907.

**Burrill. Bull. 118. Illinois Agr'l. Exp. Stat. 1907.

***Scott & Rorer. Bull. 144. Bureau of Plant Industry, U. S. Dept. of Agric. 1909.

****Selby. Bull. 130. Ohio Agr'l. Exp. Stat. 1902.

*****Swingle. Farmers' Bull. 250. U. S. Dept. of Agric. 1906.

Pruning has proved to be an effective method in controlling Pear Blight caused by *Bacillus amylovorus* (Burr.) de Toni. Both the Blight Canker and Twig Blight, different forms of the disease, may be controlled by the proper cutting away of the diseased areas. Waite** and Whetzel*** have both shown the value of this method.

Soil treatment has also proved of value in the control of certain diseases. Sirrine and Stewart**** have shown the value of applying sulphur and lime in the drills in order to prevent onion smut (*Urocystis cepulae* Frost). Halsted***** has pointed out the value of adding lime to the soil for the prevention of Club-root of cabbage caused by *Plasmodiophora brassicae* Wor.

Still another method of doing away with these losses from disease is the development of disease resistant plants. A great deal of attention has been given within the last decade to the development of resistant varieties, and this line of investigation seems to offer the most feasible line of attack in doing away with the immense losses caused by various plant parasites.

In general, two methods have been followed. It is a matter of common observation that certain individual plants survive the attack of a particular disease, while the great majority of the plants succumb. The seed of the plants which withstand the fungous attack is collected and used as the starting point for a disease-resistant variety. Selection is kept up year after year, the seed of the most resistant plants being sown. In this way the resistant variety is developed.

The second method is to cross a variety which has been found to be resistant to a disease with a susceptible variety. In this way there is combined in the hybrid the disease-resistant character of the one parent with the productiveness, adaptability for the market, etc., of the other.

---

*Moore, R. A. Bull. 111. Wis. Agr'l. Exp. Stat. March, 1904.

**Waite. Yearbook, U. S. Dept. of Agric. for 1895., pp. 295-300.

***Whetzel. Bull. 236. Cornell Univ. Agr'l. Exp. Stat., 1906.

****Sirrine & Stewart. Bull. 182. N. Y. Agr'l. Exp. Stat., 1900.

*****Halsted. Bull. 98. N. J. Agr'l. Exp. Stat., 1893.

The method of selecting the seed of the resistant individual plants for propagating the variety has been successfully employed in a number of cases. At the Colorado Agricultural Experiment Station the Pollock strain of the Rockyford cantaloupe has been found by Blinn* to be practically immune to the blight caused by *Macrosporium cucumerinum* Ellis and Everhart. This strain came from plants which had survived the attacks of the fungus. In 1904 the vines of this strain remained green on a plot on which the previous year the cantaloupes were badly blighted. Other strains around the Pollock succumbed to the disease. The matter was further tested the next season and similar results obtained.

Bolley** has developed a strain of flax which is resistant to the flax-wilt, *Fusarium lini* Bolley. For a number of years flax was grown on badly infected soil with the result that the crop was uniformly a failure. He observed, however, that an individual flax plant here and there survived and produced seed. The seed of these plants was collected and sown on the same soil and a fair crop of flax was harvested. The following year seed of this strain gave a yield of fifteen bushels of flax seed per acre on flax-sick soil, while non-selected flax gave no returns.

In a similar manner Bain and Essary*** have developed a strain of Red Clover resistant to *Colletotrichum trifolii*. In the autumn of 1905 seed was gathered from clover plants which had continued healthy, although other plants around them had died. In 1906 this seed was sown in rows which alternated with others planted with non-selected seed. Clover, dead from the disease, was scattered over the plants. By the latter part of June the plants from the selected seed were green and healthy, while those from the non-selected seed were blackened and dying. The former made a good crop and produced normal seed.

---

*Blinn, P. K. Bull. 104. Colo. Agr'l. Exp Stat. Nov. 1905

**Bolley, H. L. Proc. Amer. Breeders' Ass'n. 1:131-135. 1905.

***Bain, S. M., and Essary, S. H. Bull. 75. Tenn. Agric. Exp. Stat. Dec. 1906.

E. L. Rivers, as reported by Orton*, has developed a strain of cotton resistant to the wilt fungus, *Neocosmospora vasinfecta* E. F. Smith. In 1899 he collected the seed from a single cotton plant, which had withstood the attacks of the parasite. In 1900 this seed was planted in infected soil. It was observed that these plants were able to resist the fungus, although other plants succumbed. This wilt-resistant strain of cotton has been further developed, and its resistance increased by careful seed selection.

In some parts of the United States there is a great deal of damage done to potatoes by the late blight, *Phytophthora infestans.* de Bary. The disease may appear as a blighting of the foliage of the potato plant or as a rot of the tuber. Jones** and Stuart***, of the Vermont Station, have been endeavoring to find varieties resistant to both types of the disease. They find that some varieties are very susceptible to both blight and rot, while other varieties are relatively immune. They also find that a variety which suffers severely from leaf blight does not necessarily suffer from tuber rot. These workers have tested a large number of European varieties as well as the American. Varieties obtained from Holland showed an average percentage of rot of 5.6, while the American varieties showed an average of 37.6 per cent. Among the varieties resistant to tuber rot, the Keeper, American Wonder, and Dakota Red are listed. The Apollo and Daisy are quite resistant to both types of the disease. Stuart has also shown that the kind of soil very markedly influences the amount of tuber rot, the loss being very much less in potatoes grown in sandy soil than when grown in a clay soil.

A great deal has been done toward securing rust-resistant varieties of wheat and other cereals. For this purpose Carleton**** has introduced into this country a number of foreign wheats, especially Russian varieties. The common bread wheats, varieties of *Triticum vulgare,* in general are quite susceptible to attacks of rust. On the other hand, many durum wheats, varieties of *Triticum durum,* are relatively immune, the variety Iumillo being almost perfectly resistant. During the season of 1904 the loss of common wheats, in large areas of North Dakota, South Dakota, and Minnesota amounted to 50-60 per cent of the crop. In the case of the durum wheats the loss was 10 per cent or less, generally 3-5 per cent.

---

*Orton. Bull 27. Div. of Vegetable Physiology and Pathology, U. S. Dept. of Agric., 1900.

**Jones. Bull. 87. Bureau of Plant Industry, U. S. Dept. of Agri., 1905.

***Stuart. Bull. 122. Vt. Agr'l. Exp. Stat. 1906.

****Carleton. Bull. 24. Division of Vegetable Physiology and Pathology, U. S. Dept. of Agric., 1900.

Einkorn (*Triticum monoccum*) is also very rust-resistant. Some varieties of Emmer (*Triticum dicoccum*) are resistant, while others are susceptible. The Spelts (*Triticum spelta*) are quite susceptible to rust attacks.

The above are some of the most striking results obtained in securing disease-resistant varieties. Similar results have been obtained with other plants against a number of diseases. Varieties of the European grape (*Vitis vinifera* L.) are quite susceptible to both the Downy Mildew (*Plasmopara viticola* (B. & C.) Berl. & de Toni), and the Powdery Mildew (*Uncinula necator* (Schw.), Burr.), as well as to Phylloxera, an insect which causes a great deal of damage to the roots. In contrast, the American grapes, varieties of *Vitis rupestris, V. riparia,* etc., are relatively immune to these diseases. The Liberian coffee (*Coffea liberica* Hiern.), has very largely replaced the Arabian coffee (*Coffea arabica* L.), in the East Indies because of its greater immunity to the coffee rust, *Hemileia vastatrix* B. & Br., a fungus very destructive to the Arabian coffee plant. The Caledonian Queen sugar cane has proved quite resistant to a root rot very destructive to the Bourbon cane. The Chinese pear (*Pyrus sinensis*) and its hybrids, the Keiffer and LeConte, have proved very much more resistant to pear blight than the European pear (*Pyrus communis*). Edwards* has found that some varieties of the cabbage, as Houser, are much more resistant to the Black-rot than other varieties. According to Dorsett**, the "Lady Hume Campbell" violet is more resistant to the leaf spot fungus (*Alternaria violae*) than the variety "Marie Louise." Köck*** has found varieties of pears resistant to *Stigmatea mespili,* and also tomatoes resistant to *Septoria lycopersici.*

The second method of securing disease-resistant plants has also proved very successful in certain cases. As stated above, this method consists of crossing a resistant plant with a non-resistant or susceptible one, in order to combine in the hybrid the resistant character of the one along with the desired qualities of the other.

---

*Edwards, S. F. Ann. Rep. Ont. Agr. Col. & Exp. Farm, 33:134. 1907.

**Dorsett. Bull. 23. Div. of Vegetable Physiology and Pathology. 1900

***Köck. Ztschr. Landw. Versuch. Osterr. 10:759-761. 1907.

Most varieties of cowpeas in the South are extremely susceptible to the wilt disease mentioned above, caused by *Neocosmospara vasinfecta.* One variety, however, the Iron cowpea, has been found extremely resistant, producing seed in soil where other varieties are entirely destroyed. This same variety is also resistant to the rootknot, caused by the Nematode, *Heterodera radicicola.* Orton* has secured hybrids between this resistant Iron cowpea and the Wonderful, a non-resistant variety, and between the Iron and the Black. These hybrids combine the disease-resistance of the Iron cowpea with the productiveness of the other parent.

This same wilt-disease is also destructive to watermelons. The citron, however, is resistant. Orton** has obtained a hybrid between the watermelon and the citron which is resistant to the wilt. Unfortunately, however, the melons produced on the hybrid vines were not edible. The hybrid was again crossed with the watermelon and plants obtained, one-fourth citron and three-fourths watermelon, very resistant to the wilt, and also producing good, edible melons.

Hansen*** has crossed cultivated roses, as *Hybrid perpetual,* with hardy prairie roses and secured hybrids resistant to powdery mildew, a fungus which is often very destructive to cultivated roses.

Attempts have been made to cross resistant varieties of cereals with non-resistant with a fair degree of success. Especially interesting are the results obtained recently by Biffen****, who has attempted to show that Mendel's laws of inheritance apply to the transmission of disease-resistant qualities. In 1902 Rivet wheat (*Triticum turgidum*) and Red King (*Triticum vulgare*) were crossed. The former is relatively immune to the attacks of the yellow rust (*Puccinia glumarum*), while the latter is very susceptible. The hybrids from this cross all rusted very badly, like the parent Red King. However, 300 grains were secured, from which 260 plants were raised in 1903. The season was very favorable for rust. The plants were examined at the height of the rust attack. Sixty-four were found practically immune and one hundred ninety-five rusted, most of them badly. The ratio of 64 to 195 is nearly 1 to 3. Taken in connection with the fact that the first generation was badly rusted, it is fair proof that susceptibility and immunity are Mendelian characters, susceptibility being dominant. The results for the third generation confirm this view. An examination of four plots which contained both rusted and non-rusted plants showed 149 rusted plants and 48 free from rust, a ratio of 3.1 to 1.

---

*Orton, W. A. Bull. 17:9-22. Bureau of Plant Industry, U. S. Dept. of Agr., 1902.

**Orton, W. A. Science. New Series. 25:228. 1907.

***Hansen. Proc. American Breeders' Ass'n. 1:190-191. 1905.

****Biffen, R. H. Journal Agr'l. Science. 1:4-48. 1905. Also, Journal Agr'l. Sci. 2:109-128. 1907.

Biffen has also crossed American Club wheat (*Triticum compactum*) and Michigan Bronze (*T. vulgare*). The former is relatively immune, while the latter is a susceptible variety. The hybrids of the first generation were badly rusted. The seed of these hybrids was planted and the following results were obtained:

Plant 5a yielded 56 rust free individuals and 147 rusted individuals.
Plant 5b yielded 45 rust free individuals and 153 rusted individuals.
Plant 5c yielded 47 rust free individuals and 142 rusted individuals.
Plant 5d yielded 36 rust free individuals and 154 rusted individuals.
Plant 5e yielded 44 rust free individuals and 164 rusted individuals.
228 760

Plants 5f, 5g, 5h, 5j, gave 295 rust free plants and 849 rusted. The whole series gave 523 immune and 1,609 rusted, a ratio of 1 to 3.07.

It was observed that the severity of the rust varied on different plants. From fifty heads of badly rusted plants .8g. of seed; from fifty heads of moderately rusted plants 64g. of seed; from fifty heads of immune plants 145g. of seed were harvested.

During the past year I have been carrying on some experiments with the grass mildew (*Erysiphe graminis* DC.) on a hybrid between rye (*Secale cereale* L.) and wheat (*Triticum vulgare* Vill.) This interesting hybrid was obtained by Rimpau*, in Germany, in 1888. As a result of my experiments I have shown that the mildew occurring in nature on the rye plant cannot be transferred to the wheat. Twenty-four experiments were performed, in which sixty-six leaves were inoculated, none of which became infected. When, however, the rye mildew was sown on rye plants, infection occurred in nearly every case. Fifty-eight experiments were made, one hundred and thirty-eight leaves being inoculated; one hundred and thirty-one of these became infected.

---

*Rimpau. Landw. Jahrbücher, 20:335-371. 1891.

When the mildew occurring in nature on wheat is sown on rye plants, no infection occurs. This is shown by the fact that 25 rye plants were inoculated in ten experiments, none of them becoming infected. When the wheat mildew is sown on wheat plants, infection always occurs, for every one of 178 plants inoculated in sixty-six experiments became infected.

These experiments show that the mildews on the wheat and rye are entirely distinct. The mildew on one cannot be transferred to the other plant. At the same time, no morphological differences between the two mildews can be detected. They look alike under the microscope. Yet each is sharply limited in its growth to certain plants.

The question then arises as to how these two mildews will behave towards the rye-wheat hybrid. The mildew from rye was sown on eighteen leaves of the hybrid in thirteen different experiments. Nine of these leaves became infected. The wheat mildew was sown on sixteen leaves of the hybrid in ten experiments. Only one leaf showed any evidence of infection. These results indicate that the hybrid is practically immune to the wheat mildew, a fungus which grows perfectly on one of its parents. The hybrid is also less susceptible to the rye mildew than is its rye parent.

In this connection it is interesting to mention an experiment by Eriksson* on some of Rimpau's rye-wheat hybrids. Eriksson found a form of *Puccinia dispersa* Eriks. and Henn. growing abundantly upon rye-wheat hybrids obtained from Rimpau. He states that the hybrids seemed to be more like the wheat plants than the rye. It is well known that there are two distinct forms of *Puccinia dispersa,* the form *Secalis* on rye, and the form *Tritici* on wheat. Eriksson sowed uredospores from the infected hybrid upon three rye plants, and also upon three wheat plants of the same age. Eleven days later a rich growth of the rust appeared upon the inoculated areas of the wheat plants. No infection occurred on the rye, although the plants were kept several days longer. It is apparent, then, that this hybrid had a well marked resistance to the form *Secalis* of *Puccinia dispersa,* while it was entirely susceptible to the form *Tritici.*

---

*Eriksson. Botan. Notiser for 1895, pp. 251-253.

From what has been given above, it is evident that great advances have been made in the development of disease-resistant plants. Sufficient has been accomplished to encourage the plant pathologist to seek for further resistant types of plants. It is quite possible that much of the annual loss due to diseases of various kinds may be very largely done away with by the introduction and development of varieties of plants more able to resist the attacks of the common diseases.

Both of the methods for securing disease-resistant plants considered have been successful. The method of selecting the seed of resistant individuals for propagation seems to be the easier and more certain, because it is often difficult to get combined in a hybrid all of the qualities desired. While the disease-resistance may be obtained, other important qualities may be lost. The method may require repeated trials to get the type of plant that is desired.

So far not much progress has been made towards the solution of the question as to why certain plants are immune to a particular parasite, while other closely related plants are susceptible. In general, two views have been advanced, each with considerable evidence to support it. According to one view, the resistance or susceptibility depends upon some morphological character of the plant. Stuart* states, with reference to the resistance of varieties of potatoes to blight, that, "in general, varieties having a strong, woody, moderately branched, upright haulm, and medium sized, rather thick, more or less crumpled, firm, hairy leaves, were found more resistant to disease, especially late blight, than those possessing rather weak, partially woody, much branched, decumbent haulms, with rather large, thin, smoothish, soft leaves. In brief, varieties having an upright habit of growth, moderately branched, with firm, hairy, medium rigid leaves, are much more likely to prove resistant to late blight than are those with large, smooth, flabby leaves and decumbent stems." Jones** mentions that red varieties, with thick, rough skin, are more resistant to tuber rot than thin skinned, white varieties.

---

*Stuart. Bull. 122. Vt. Agr'l. Exp. Stat. 1906.

**Jones. Bull. 87. Bureau of Plant Industry, U. S. Dept. of Agric. 1905.

Hartig* mentions the fact that *Salix pruinosa* sometimes suffers severely from the willow rust (*Melampsora Hartigii*). In place of the glabrous-leaved *Salix pruinosa,* he recommends the cultivation of the hybrid *S. pruinosa* x *daphnoides,* the latter being pubescent, and thus better protected against infection.

As opposed to this view that susceptibility or immunity depends upon some morphological or anatomical difference in plants, another view has been advanced, namely, that resistance or susceptibility depends upon the presence or absence of certain substances in the cells of the plant. The resistance is due, not to structural differences of the plants, but to a chemical difference in their protoplasm. Ward**, in his work with the rust of the Bromes, has investigated very carefully the number and size of the stomata and hairs per square millimeter of surface on both the upper and the lower sides of the leaves, the breadth and thickness of the leaf, the proportions of vascular tissue to chlorophyll tissue, and so forth. He finds no correspondence between any of these measurements and the predisposition or immunity of any species. He concludes that "the capacity for infection or for resistance to infection is independent of the anatomical structure of the leaf and must depend on some other factor or factors in the plant."

Further work along the line of the development of disease-resistant plants will undoubtedly throw additional light upon this question. If we knew why one plant was resistant and another susceptible, we would be much farther along in controlling plant diseases than we are without this knowledge.

---

*Hartig, H. Textbook of the Diseases of Trees. Translated by Somerville and Ward. p. 171. 1894.

**Ward. Proc. of the Cambridge Phil. Soc. 11:307-328. 1902.

MISSOURI HORTICULTURE.

(By Dr. J. C. Whitten, Professor of Horticulture, University of Missouri.)

In general horticultural interests Missouri is a leading State. In certain fields of horticulture she leads all others. According to the last census report Missouri possessed over twenty millions of apple trees in her orchards, or thirty-three and one-third per cent more than any other State in the Union. In the area and fame of her peach orchards she ranks among the first.

One of the leading commercial strawberry regions of the country is located in southwest Missouri. Two thousand carloads of strawberries have been shipped annually from the State. One single small town has shipped over thirty carloads of strawberries in a single day.

Liberal, Barton county, has gained the distinction of being the largest blackberry shipping point in the United States. Blodgett, in southeast Missouri, shipped more watermelons than are sent out from any other shipping point in the Union.

Probably the largest orchard in the world is located in Missouri. There are several orchards in the State that number their acres by the thousand. The most extensive single nursery in the United States is located in eastern Missouri.

Scores of commercial varieties of fruits have had their origin in this State. Fully a dozen Missouri varieties have become recognized throughout the Union as distinct acquisitions to the pomology of this country and scores of newer forms are fast coming into prominence. Among these one recalls such apples as the Gano, Missouri Pippin, Huntsman's Favorite, Payne's Keeper, Nixonite, Lawver, White Winter Pippin, and others. The Missouri Mammoth quince is another Missouri product. Such plums as Gold, Missouri Apricot, and others have had their origin here. The State will be remembered for her grapes, originated by Herman Jaeger, Jacob Rommel, Samuel Miller, Henry Wallis and others. The Captain Jack strawberry, the Evans raspberry, and numerous others originated in Missouri, have been disseminated countrywide. The persimmon, known only as a wild fruit a few years ago, is now yielding to domestication and prominent valuable cultivated varieties are being grown. The amelioration of this species has perhaps had its greatest stimulus here. The Marion, Josephine and New Harmony varieties are associated historically with this State and the Miller, recognized as the most superior variety of this fruit, had its origin on the grounds of a veteran fruit grower near Kansas City.

Among our ornamentals, the Weeping Mulberry, originated at Carthage, is now seen in all the leading public parks of the country, along with the White-flowering Cercis, Thornless Honey Locust, and many other ornamental trees, shrubs and vines which were developed from wild species in this State.

The Soulard type of crab-apples, remarkable for their large sized fruit, were naturally disseminated in the wild throughout this State. They are the foundation material with which the horticulturists have begun to ameliorate cutivated strains of native American apples resistant of many of the diseases to which the introduced apple is heir and hardy in bleaker regions of the northwest, where the European apple fails. Specimens of these Missouri wild crabs nine inches in circumference have been produced on wild trees. Even this type of fruit is undergoing rapid improvement through modern methods of plant breeding.

Natural conditions in Missouri favor great horticultural development. The undulating surface, variety of soil formation, medium climate, well distributed rainfall, central geographical location and other factors are horticultural advantages. The Mississippi and Missouri rivers, together with their tributaries which intersect all parts of the State, afford unexcelled facilities for water drainage and atmospheric drainage. Horticultural products generally thrive best on well drained soils. Atmospheric drainage is equally important.

Among the best fruit soil formations may be mentioned the "loess," a silt-like deposit which lies in a strip from one to twenty miles wide along the Missouri river bluffs, and which occurs here and there along the bluffs overlooking the Mississippi. In the southern half of the State the Ozark uplift presents an immense area containing almost ideal fruit soil in which some of the largest orchards in the world have been developed.

The medium climate of the State favors the growth of a great diversity of horticultural products. The native flora embraces both northern and southern species and it is interesting to note how eastern and western species overlap in this particular section. In this central position, with its variety of soil, the State combines conditions that favor the growth of a wide range of species of cultivated plants. In this connection it is of interest to note that the native wild crab and June-berry, capable of enduring the rigors of northern winters, flourish here in the same woods with the more southern papaw and persimmon. Among grapes the northern, southern, eastern and western species, and their cultivated varieties thrive.

Cultivated varieties which have sprung from the eastern Fox grape, the Northern Riverbank grape, and the southern Postoak and Mustang grapes are grown in Missouri vineyards. Even the

MISSOURI SCENERY.

(View along the Missouri river in Boone county, at the mouth of Perche creek, near McBaine. The bluff land here consists of the famous loess soil, the best for fruit purposes to be found.)

southern Muscadine, of which the Scuppernong is the best known cultivated representative, is found native in southeast Missouri.

Among our plums the northern American species and the southern Chickasaw plums blend together and cultivated representatives of both these species are of importance in Missouri orchards. The Sand-plum and the Sand-cherry of the semi-arid districts of the West are finding a place in Missouri horticulture. The wide range of adaptation of soil and climate to varied groups of native plants is of horticultural significance, not so much on account of the economic value of some of these native species, but because it proves that the State is adapted to the growth of a great variety of horticultural products.

The annual rainfall is ample and quite well distributed. The average for the year is approximately 40 inches. The months of April, May, June and July show an average of five inches of rainfall annually for each of these months. This is the season of the most abundant wood and leaf growth of fruit trees and berry plants and consequently the time when they require the greatest amount of water. The months of August, September and October show an average decrease in the amount of rainfall. This is favorable to the ripening of fruit and to the maturing of the wood of the plants to withstand the coming winter. During August, September and October, when most of the fruit is maturing, the average number of sunny days is considerably higher than that of most of the other leading orchard States. The intense sunlight of late summer and autumn and the proximity to arid prairies are important factors in the beautiful coloring and high flavor of Missouri fruits and they no doubt account in part at least for the comparative freedom from many of the fungous diseases which are known to thrive best in moist, cloudy atmospheres.

Missouri's central position is favorable to the marketing of the immense horticultural product. As the fifth State in population in the Union, there is a local demand for a large fruit product. In addition to this, perishable fruits like berries and peaches are sent to the principal markets east of the Rocky Mountains, while the Missouri apple is capable of reaching practically all the great markets of the world. The State also lies just at the eastern gateway of the grain-growing, grazing and mining districts of the west and northwest. Many of these districts, while rich in other interests, do not produce fruit enough for home consumption and they offer a growing market for Missouri products. Easy railroad connections with Gulf ports affords convenient shipments to European countries.

GRAPE GROWING.

(By L. Coutant, Monett, Missouri.)

As a grape grower, I found out long ago that the key to success is to plant varieties that are free or comparatively free from rot and mildew. This saves much time and trouble and the expense of spraying. Furthermore, some non-resistant varieties will be ruined in spite of all the spraying we can give them.

In Missouri, we must pay attention to the Aestivalis class of grapes. The true home of the wild species of Aestivalis is in southwest Missouri, Arkansas and Oklahoma, in the celebrated Ozark hills. Then, it is a good plan to follow nature and plant hybrids or seedlings of those varieties, as the wild grape itself is not relished either for wine making or for table purposes by the people.

The eastern states are well provided with the Labrusca class of grapes, as this species, in the wild, is native to that region. The Labrusca is better adapted to the eastern and northern states by nature than any of the other species but on the whole, Aestivalis and Riparia are far better for the making of wines of fine quality and, we have also some varieties of that class which make fine table grapes.

Another way of securing good results as regards fine quality, is to mix the different varieties and classes in a plantation. Cross fertilization of varieties works wonders in that line and this method is far superior to the old practice of planting acres and acres of the same kind, without any mixing. It is advised to plant two rows of one variety and the next two rows of a different variety, but the two kinds must bloom at the same time to insure cross pollination; also pistillate kinds must be set at closer intervals than staminate sorts. In a small vineyard, plant ten or twelve vines of one variety, then ten or twelve of another and so on, with attention paid to blossoming season.

I keep my land well fertilized with stable manure, commercial fertilizers, natural and organic manures, so as to get a strong growth, for the more foliage there is the better will be the quality of the grapes and sometimes, too, I allow weeds to grow a foot high or more and plow them under, thus giving much additional nutrition to the roots.

For the pruning of grapes, I use the renewal system for Labruscas and for Aestivalis and Riparia a system of spurs but occasionally using a combination of the two.

I have been experimenting for over twenty years with the matter of digging deep holes when setting grape plants, and the following plan, I have decided, is the best one to pursue: Dig holes a foot and a half or two feet deep, the deeper the better, put a layer of loose rocks in the bottom about one foot thick, cover with good soil up high enough to receive the vine which is then planted. This will afford good drainage and obviate the necessity of tiling which is expensive. The mass of loose stones form a sufficient open space for all necessary circulation of air and at the same time the roots at all times are kept sufficiently moist, even in very dry seasons. Another point gained is the protection from spring frosts because the drier the land is the less the grapes are hurt by frost. Also by grafting cultivated varieties upon wild forms, and by means of the well-drained soil, grapes may be rendered almost frost proof. Digging deep holes and filling up the bottoms with bones, decayed vegetables, etc., is good too, but the plan described is superior to it.

In the selection of varieties of grapes for a vineyard in central and southern Missouri, and also for the central states, I would suggest for table use, Fern Munson, Woodruff's Red, Moore's Early, Elvira, Perkins, Noah, Ives Seedling, Brighton and some of the Rogers' hybrids as Agawam, Salem and Goethe—but the last three are uncertain and rot more or less.

For wine grapes I would recommend America and Cynthiana. Clinton, Bacchus and Montefiore make fine wines but they rot badly and I would plant only a few vines of them. Also Elvira, Noah and Missouri Riesling are fine for white wines. I had to discard Hopkins; for the first few years that variety was very promising, but later on proved unreliable. Brilliant is about the same way. I am experimenting now on a number of wine grapes, such as Wine King, Amertonte, Muench, Neva, Extra, Ben Hur, Captain, Cloeta by Munson of Texas, and also with some of my own production, and certainly they will mark a new era in the industry of wine-making in Missouri and neighboring states.

FUNDAMENTAL PRINCIPLES OF PRUNING.

(By Charles Dearing, Columbia, Mo.)

Pruning, spraying, planting, cultivation, harvesting and marketing, are fundamental horticultural practices. While all of these practices are of utmost importance to a successful horticultural business, it may be truthfully said that pruning and marketing are most important. It is these practices that require the most judgment—the clearest understanding of existing conditions and future possibilities.

Very little can be said or written in regard to marketing, for success or failure is entirely due to individual judgment and business ability. No one, for example, can tell any one else how to market a crop of apples, as conditions and market requirements are continually changing.

The same is true to a great extent of pruning, for one will never know how to prune, when to prune or what to prune until he has worked and lived with plants, until he understands their peculiarities and above all their plastic nature. However, there are certain general principles which apply to all pruning practices, no matter how varied.

It is astonishing how many conflicting notions there are in regard to this practice. And yet, all may be right under given conditions. For example, on the grounds of the Missouri Experiment Station it has been found best to summer pinch grapes in order to get the canes to thicken up and form strong buds close to their bases; the natural tendency being to form long wild growing canes, having most of their buds near the distal end. This habit is due to the heavy clayish nature of the soil. The grape growers of the loess soil of the Missouri river bluffs, less than ten miles away, do not summer pinch for the soil is such that the vines naturally grow to perfection.

Since there is no best method of pruning adapted to all localities and conditions, and since there are so few lucid conceptions of the real problems at issue in pruning, it is the purpose of this paper to discuss those fundamental principles which apply to all pruning operations, and the factors which modify their results.

The importance of pruning cannot be realized until we consider its wide application. It is one of the most effective means of the plant breeder in causing variation. The vegetable gardener suckers his tomato plants in order to throw the more vitality into the fruit. The florist carefully cuts away all the flower buds of his giant chrysanthemum but the one chosen to bloom, in order that this one may reach the greatest possible size. The landscape gardener prunes and trims his shrubs and hedges in order that their charms may be intensified, and that they may conform more perfectly to the general picture. Last but not least, the fruit grower prunes his trees and vines, and bushes in order that his fruit may be more perfect, more beautiful and more delicious.

1. The first fundamental principle that we must get clearly in our minds is that pruning is not a devitalizing process. It is often argued that pruning is unnatural and is therefore detrimental to the welfare of the plant. The error of this statement is at once apparent when we think of the vast amount of pruning occurring under natural conditions. It is a common sight to see the forest floor covered with sticks and litter which were at one time branches upon the trees overhead. The long, bare, shaft-like trunks are but monuments to the number of branches that once grew out from them. L. H. Bailey in "The Pruning Book," cites an instance in which a little, wild black cherry tree only four and one-half feet high, had, during the two years of its life, made an effort to produce four hundred and nine branches. It is plain that more than ninety per cent of these efforts must be futile, for in the struggle for existence the branches will crowd out and kill each other. Pruning then is not contrary to the laws of nature.

Moreover, plant physiology teachers us that the plant is very largely what its food supply and other environments make it to be. If it is continually renewed and augmented, then the removal of a portion of it will not destroy its vitality, unless the removal is so great or at such a time as to interfere with the nutrition of the remaining parts. It is here that the summer pruner often makes a mistake by removing branches as soon as they have ceased to elongate rapidly, and before they have had time to pay back to the tree the food they have used up in making their growth. It is evident then, that in so long as the pruner does not go beyond the bounds of common practice, there is no danger of devitalizing the plant. On the contrary the reverse is true and this brings us to the second fundamental fact in regard to pruning.

2. Heavy top pruning rejuvenates the plant and causes the production of new wood. A plant growing under normal conditions has a perfect balance of top and root. The root and shoot

are mutually dependent, one upon the other. The root takes in the coarse plant food from the soil, but can make no use of it until it has been elaborated in the leaves. The greater the root system the more food taken in, and the greater the amount of leaf surface required to build up this food into the living substance. If then by heavy pruning, a large portion of the top is removed, the balance between root and shoot is broken, and therefore a greater amount of plant food will be available for the remaining branches. As a result, the growth of these remaining branches is accelerated, or as is often the case, dormant buds push out and begin to grow at an increased rate, forming water sprouts or suckers.

This does not mean that the tree will be larger than if it had not been pruned, however, for pruning, in fact, is a dwarfing process, since a reduction of the top will cause a reduction of the root system in so far as it will grow less the following season than it would otherwise have done. At the Woburn experimental fruit farm experiments have shown that as compared with moderately pruned trees, those heavily pruned are twenty per cent smaller, while those not pruned are twenty per cent larger after a period of thirteen years. (Journal of the Royal Horticultural Society, Vol. 33, page 489). However, if a plant, a peach tree for example, is not pruned, it will sooner or later begin to fail from general loss of vitality. While cultivation, fertilization, etc., will tend to cause rejuvenation, they are not nearly so effective as a rather severe pruning. This is because the remaining parts receive more food. While it is impossible to throw more life into a weak branch, it is possible to cause the dormant buds to awaken and form new branches. In this way, it is often possible to form an entirely new head.

These statements find admirable application in the case of peach trees which have been winter killed. Experiments at Missouri Experiment Station (Bul. 55), show conclusively that the best method of procedure is to head back severely, even into three and four-year-old wood. Under such treatment, the dormant buds along the remaining branches will form new heads of vigorous wood. In the case of the peach there are two other advantages to this practice besides the factor of rejuvenation. One is that strong fruit bearing wood is produced, and the other is that this bearing wood is kept close to the body of the tree and the natural tendency to form long, weak, pole-like branches with the bearing wood at their ends is overcome. It is thus seen that pruning of the top tends to produce new wood and to rejuvenate old and weakening plants.

3. Heavy root pruning tends to lessen the production of wood. This fact is the reverse of what has been said. If the lessening of the top causes an increased supply for the remaining top, the removal of a portion of the root system will lessen the supply of food to the whole top. In other words, the food supply is cut off and it is impossible for the plant to form new wood without food, except by drawing upon its own vitality, and this a plant refuses to do. For example, a planter always prunes the tops of plants in transplanting, in order that they may conform to the reduced root system. When the root system is reduced, it is necessary to reduce the area to be supported.

4. The best pruning when one is concerned with the fruit and welfare of the plant, is that which allows the plant to take its natural form. Every plant is unlike every other plant and should be pruned differently. With the possible exception of the small fruits, the grape is subjected to the most systematic pruning of any of our fruits, yet, how differently we prune the different vines! Every vine is a different proposition. Here we may encounter a vigorous Concord vine of the Labrusca type or a rank growing Neosho of the Aestivalis type, and there we may meet a delicate Lindley or Goethe of the Vinifera Hybrid type. It would be folly to prune these varieties alike. Moreover, even in the same variety there are differences in vigor and form of the vine which are sufficient to cause them to be pruned quite differently.

5. The habit of a plant varies from youth to old age. Young plants are as a rule, vigorous growers, while old plants make slow growth. An exception to this is found in the case of some forest trees of which the long-leaf pine is one. These trees grow very slowly at first, but later become very rapid growers. Young plants tend to make long upright growths, while old plants grow more spreading. The Keiffer pear, for example, grows exceedingly upright at first, but later when the trees begin to bear fruit, the limbs are pulled down by the weight, and the tree becomes more spreading. In pruning young trees this fact should be remembered, for while branches may seem to crowd each other at the time, they will spread apart later.

6. In pruning we should remember also that one part of a plant lives at the expense of another part. Elaborated plant food is distributed by assimilation to every living portion and organ

of the plant. In the fall some of the elaborated food is stored for the use of the early growth of spring shoots. Moreover, the more vigorous the shoot, the more it draws upon the rest of the plant. Sorauer says (Physiology of plants. Trans. by Weiss, page 146), that "It must not be forgotten that at the commencement every young shoot draws like a parasite upon the food material of the older branch; this applies as much to the consumption of water as to the stored up material." Bailey says (The Pruning Book, page 155), that "One shoot may rob another and thereby grow the faster." Water sprouts and suckers are such shoots and should, therefore, always be pruned before they have had time to accomplish their work.

7. Water sprouts are the result of disturbed equilibrium of the plant; and the formation of water sprouts is influenced more by the vigor of the plant and the amount of pruning than by the season of the year in which the pruning is done. It is rare for water-sprouts to occur on unpruned plants, though this sometimes happens, as in the case of catalpa and sycamore trees. While vigor and pruning have most to do with the formation of water sprouts, the season has an indirect influence. For instance, it is seldom that they form after mid-summer. Therefore, summer pruning after mid-summer may probably be performed without fear of water sprouts, for the chances are that by the next spring the plant will have had time to readjust itself. Subsequent pruning is the best remedy for water sprouts.

8. The tendency of plants is to grow from the uppermost buds. It is only natural that such should be the case, for in the struggle for existence between the buds of a branch it is the upper and outermost buds that are best supplied with light and air, and with this advantage they naturally overcome the others. This tendency is especially pronounced in young plants. In the case of an avenue of young elm trees growing in front of the Horticultural Grounds of the Missouri Experiment Station, the writer has noted that in nearly every case it is the terminal buds that have made the new growth. The thing is so evident that one may stand at a distance and tell the exact age of many of the trees. Two seasons ago a branch on one of these trees produced twenty-one buds. The following season the five lowest buds failed to open, the next nine buds formed weak branches which are now dead, or dying, and the seven distal buds produced branches ranging in length from five inches to thirty-one inches.

We may prune in such a way as to augment or thwart this tendency. It is often desirable to thwart it, as in the case of the peach, the grape, or the small fruits. For example, if the growing canes of the black raspberry are allowed to take their natural course, they produce an exceedingly long, weak, whip-like growth having no side branches. Whereas, if when the shoots are about one to two feet high they are summer pinched, or later if their tips are directed at once to the ground so that they may take root, an abundance of side branches are formed, a great deal of food material is stored up and the plant is kept within bounds. The means of thwarting this tendency are heading in, and checking the upward flow of sap by such processes as girdling, bending, twisting, etc.

9. The heading-in of young growths tends to develop the lateral and the dormant buds. That is to say, heading-in causes a thickening and broadening of the top. This has been explained above in the case of the black raspberry. In dwarf trees heading-in is necessary in order that the top may not overbalance the root. Young trees should also be headed-in more severely than old trees, for by so doing, the early branching of the scaffold limbs is induced, thereby making the tree more stocky. As the tree becomes older, the heading-in should become less and less, as mature fruit-bearing trees rarely grow too rank; and if such should be the case, the rational procedure would be to withhold cultivation and fertilization, for top pruning would only augment the trouble and root pruning would not be practicable. Again, heading-in causes the production of fruit buds and is the process by which the landscape gardener trains his shrubs and hedges to definite shapes.

10. An obstruction just above a bud or branch tends to produce strong longitudinal growth in that part; whereas, an obstruction just below a bud or branch tends to produce a thickening of the part and the storing of food. It has already been shown that heading-in causes accelerated growth of side branches and this is simply a complete obstruction of the upward flow of sap. The sap arising from the roots passes up through the sap wood, while the elaborated food passes down through the cambium. If then an obstruction is placed just under a bud, the bud will receive all the food which should go to the parts below, and the result is a thickening of the parts, for the disposition of elaborated food from the leaves is to build up tissue.

The grape furnishes an admirable illustration of this principle. In the renewal system of grape pruning it is a general practice to go over the vines in early summer and pinch, twist, or in some other way obstruct the sap flow of the young shoots which are to form the fruiting canes the following year. This causes the canes to make short, stocky growth, rather than long, rank growth. The buds formed above the obstructions are thick, healthy and close together, and the cane presents a zig-zag appearance due to the great amount of food stored in the buds. By this means, healthy, stocky, vigorous canes are secured close to the head of the plant, which is of course very desirable.

11. It may be said then that checking growth, so long as the plant remains strong and healthy is conducive to fruitfulness. A very strong growing plant seldom produces fruit. Cultivation and fertilization may be carried to such an extent as to cause over-production of vegetative growth at the expense of fruit production. Pruning may do the same as in the case of heavily pruned ornamental plants, which are never fruitful. On the other hand, deep notching, girdling, pinching, bending and twisting and any other method of checking vegetative growth, such as root pruning, dwarfing, etc., will cause the production of spurs and fruit buds.

12. Fruit bearing, however, is determinined more by the habitual performance and condition of the plant, than by the kind or extent of pruning; it is associated with a quiescent rather than with a stimulated or spasmodic state; and the habit is more subject to treatment when the plant is young than when it is old. All plant breeding is based on the fact that no two plants are alike, and this fact of variation is as true of the character of fruit bearing as of any other character. This variation is due to the different environments under which the plants grow. It is possible, however, to so regulate the environment of a plant by continuous good care as to make it tend toward the fruit bearing habit, particularly when the plant is young. It is natural for the plant to bear fruit and when this habit has become established it should be maintained by continuous good treatment.

With such plants, anything which disturbs the equilibrium of the plant will tend to upset the bearing habit. It is evident then that severe pruning is to be avoided in the case of bearing trees, and that the rational practice is to prune slightly each year rather than to prune severely in alternate years. This principle is of utmost importanceee. The fruit grower must depend more on good care, thoughtful and consecutive management year by year, than on disconnected, heroic, unnatural treatment once in a great while. There is no more practice so far from right as the ill advised butchery or topping of the shade trees so often seen in our towns and cities.

However, there are times when severe treatment is demanded, as in the case of a neglected or unfruitful apple orchard. Here is a case where it is necessary to cultivate, fertilize, prune, spray and do everything possible to rejuvenate the plant. This, however, will not of itself bring fruitfulness. It will only renovate and correct the neglect of previous years, and it will remain for the grower to begin anew to carry forward thoughtful, consistent, and conservative treatment.

What has been said does not neecessarily mean that it is only the slow growing tree that bears fruit, for the bearing habit is sometimes a question of individuality or variety, sometimes a question of local environment, but oftener a question of good rational care begun when the plant is young.

13. All means of obstructing the movement of sap—as notching, girdling, shredding, bending, twisting and pinching or crushing—are matters of special or local application, and are to be associated more with modes of training than with pruning proper. They are of secondary importance and find application only in extreme cases where other means have failed. Their chief use is to bring tardy plants or branches into bearing.

The operation which gives least irritation to the economy of the plant is the bending of shoots. Branches are bent from a more or less vertical to a more or less horizontal position. The effect of the bending depends chiefly on the mechanical change which the tissues undergo at the bend, the lower side being kinked while the upper side is stretched. The same results are produced when horizontal branches are bent upwards. This operation (bending) is often used in trimming grapes to the Cordon form.

The twisting of shoots acts in the same way but much more energetically. In the layering of quinces and grapes, the shoots are often twisted at the point where roots are wanted, as the elaborated food passing down from the leaves accumulates at the wound and hastens the production of adventitious roots.

Notching is sometimes used by the fruit grower to compel a certain bud to develop in order to obtain trees of a definite shape.

Ringing, or girdling, must never be looked upon as an arboricultural practice, for it is an extremely unnatural treatment and generally entails the early death of the member. It is used for making tardy trees bear, and finds special application in the case of grapes and small fruits, for it makes no difference if the canes are killed, provided they bear a crop of fruit, since they must be cut out anyway at the end of the season. The most dangerous operation which is performed upon the living tree is the peeling away of the bark. The operation is simply an extreme case of girdling. Both operations should be performed in the mid-day heat of a hot summer day.

14. Heading-in may induce fruitfulness by checking excessive growth and by encouraging short lateral growths. We have already said that heading-in tends to develop lateral branches, and we must now correlate these two facts. Heading-in the top causes a surplus of food material which may be used in the production of strong lateral branches, or in the formation of fruit buds, or as is often the case, in such fruits as the apple and pear, it may cause a formation of short spur-like branches bearing fruit buds. In so far as heading-in tends to check wood growth, it causes the formation of fruit buds, but severe heading-in is nothing more than heavy pruning, and will cause the very opposite of fruit bearing. No definite statements can be made as to the amount of heading-in which will cause the greatest formation of fruit buds, for everything depends on the age and vigor of the tree and its fruit bearing habit. In general, however, slight systematic heading-in less than one-third the yearly growth—will tend to form fruit buds, while more severe and occasional treatment will cause wood production. It must be remembered that heading-in often has other objects than wood and fruit production, for it is a means of thinning fruit, keeping plants in shape and balance, and preventing dwarf trees from outgrowing their stocks. For practical purposes, the value of heading-in as a means of securing fruitfulness is often overestimated.

15. The season has a marked influence on the habit of fruit bearing—winter pruning tends to produce wood whereas summer pruning does not. Winter pruning is the removal of shoots during the resting period, while summer pruning is the removal of shoots during the growing and maturing period. In general, it will be found that winter pruning is strengthening, while summer pruning is weakening. During the growing season the root system and top make equal or rather balanced growth, so that the root system is able to absorb enough water for the whole plant. If, then, during the dormant period, a portion of the top is removed, the same amount of water has a reduced field of labor, and the result is that the remaining branches make stronger growth than they otherwise would have done. By pruning in summer immature shoots

are removed. This is necessarily a weakening process, for in expanding its leaves, the young shoots draw heavily on the parent branch, and when first formed they are only able to elaborate enough food for their own use, and it is only after full development that it begins to work for the good of the branch. It is therefore seen that by removing young shoots the tree is robbed of food material which must mean a weakening. However, this weakening may often be overlooked, if any other advantage, such as fruit bearing, is gained.

Summer pruning is a much abused practice, due to a misunderstanding of its aim, its application, and its possibilities. There are those who bitterly condemn the practice, while others sing its praises. One reason for this misunderstanding is that the word is applied to two entirely different operations—one the removal of large branches and the other the removal of parts of small shoots by a process better called summer pinching. It is rare that summer pruning proper is advisable, while summer pinching is a more or less common practice. The remarks of this discussion will apply, therefore, only to summer pinching.

Summer pruning or pinching is dependent on:

1. The form of the tree dealt with.
2. The nature of the stock upon which grafted.
3. The nature of the root system developed.
4. The nature of the variety.
5. The method of winter pruning.
6. The age of the tree.
7. The character of the soil.
8. The character of the season before and after pruning—(Journal of the Royal Horticultural Society, Vol. 33, page 487).

Sorauer says, "The greatest success will result from this process, if pinching takes place just at the period when the buds have still sufficient time to swell up and become stored with food material, but when the supply of water begins to diminish, so that the upper buds will not grow out into long secondary laterals as is often the case with such trees as the peach and ash.

"To prevent disappointment, we state emphatically—as the practice is very common—that no fixed rule can be layed down for the commencement of summer pruning. Trees may even be pinched to death. The favorable time for this operation depends on the climate, the soil, the variety, and even upon the individual characteristics of the plant."

The results of summer pruning are various. First, it causes the production of fruit buds and spurs, for when food becomes stored in a bud the result is invariably the production of a fruit bud. If performed early enough, the bud of the present season may become a fruit bud, but as is oftenest the case, this bud grows out into a short spur which forms a fruit bud the following year. Second, ordinary summer pruning is beneficial because it makes the plants look neater, as, for example, the pruning of ornamentals. Third, summer pruning is beneficial, because it lets in light and air, which enables the fruit to develop to its fullest color and beauty.

Summer pruning may be accomplished by various methods, and serves the same purposes as root pruning and dwarfing.

Nature summer prunes through the attacks of aphids, etc. However, it is possible to carry pinching to excess, just as winter pruning is overdone, for plants will not lend themselves to mechanical processes. However, plants bearing fruit on one year wood, such as the peach, and plants having the co-terminal habit, such as the grape, blackberry, raspberry, etc., are necessarily much more artifically treated.

16. The effect of pruning, as well as the necessity for it, depends greaty upon locality and climate. Not only does the habit of the plant vary in different localities, as, for example, in the case of grapevines when in the loess soils along the Missouri river bluffs and when grown in the clay soil eight or more miles north of the river; but there are local dangers to be avoided. In the plains of the central part of the United States, it is the general practice to do the minimum amount of apple pruning and to train the trees to a more or less low, dense head with a central leader, while on both the Atlantic and Pacific slope, the maximum amount of pruning is done, and the trees are trained to a high, open, wine-glass form. Both practices are right in their given localities, for in the central states a rather dense head is necessary to prevent sunscald in winter, and in summer the sunlight is so intense that the fruit colors and ripens perfectly even though the heads are closed. On the coasts, however, there is little damage from sunscald, and the sunlight is not near so intense. They, therefore, open up their trees in order that the fruit may have the benefit of what sunlight there is.

16. The healing of large wounds caused from pruning is chiefly influenced by the kind of plant, the general vigor of the plant, their position on the plant, the length of the stump, the

character of the surface as to smoothness or roughness, the healthfulness of the wood, and the season in which the cut is made.

17. Dressings do not hasten the healing of wounds, but they allow the healing to progress unchecked, because they ward off disease; a good dressing, therefore, is one which is antiseptic, and durable, which affords mechanical protection, and which does not itself injure the tissues.

18. Pruning may influence hardiness. This principle of pruning has been the subject of careful investigation made by Mr. W. H. Chandler, Assistant Horticulturist at the Missouri Experiment Station, and is discussed in Bulletin seventy-four of that station. It is found "that in most of Missouri at least, fruit buds on peach trees that have made rather a vigorous growth, caused by reasonably severe heading back or by cultivation, are the less liable to winter injury." This is because the cutting back forces the tree into vigorous growth so that growth continues much later in the fall. This throws the really dormant period farther into the winter, so that the buds are not started into growth by the warmer days of late winter. A table from Bulletin 74, illustrates this point.

Buds on twigs taken December 2nd that had started by December 21st:

Variety.	Total No. of buds.	No. of buds started.	Percent started.
Elberta	39	26	66.6
Elberta (cut back)	39	0	0.0
Early Tillotson	92	5	5.4
Early Tillotson (cut back)	69	0	0.0
Old Mixon Free	83	4	4.8
Old Mixon Free (cut back)	88	2	2.2

It seems that in every case the cut back and more vigorous growing tree had the least per cent of buds started.

It was further found that the thinning of the fruit made the fruit buds more hardy. A number of trees were thinned on one side only and in every instance the fruit buds on that side were the hardest to kill. Any method of pruning, then, which would thin the fruit would tend to make the tree more hardy, and heading-in is such a practice.

Again it was found that the buds at the base of a branch are hardier than those at the tip. For instance, in the case of Elberta (not cut back) 76.6% of the buds on the distal half of twigs were killed during the winter of 1905-6, against 55.9% of the buds at the base of the twigs, and on Elberta (cut back) 56% were killed on the distal half, as compared with 40.0% on the basal half. Pruning, then, to an open head will tend to increase hardiness by letting in light enough to cause the formation of fruit buds at the base of the whips.

19. Pruning may be made a means of warding off fungus diseases. An open-headed plant is not so susceptible to fungi as a closed head, for fungi avoid the light except in the fruiting stage. An exception to this is in the case of the black rot of the grape (*Laestadia bidwellii*). This fungus thrives best in the light, as shown by the fact that sacked or shaded clusters are generally free from the disease, while clusters exposed to light are generally attacked.

20. Lastly, the best pruning is that which results from a definite purpose or ideal, which is founded on a consideration of fundamental principle and a careful study of all the local conditions and special pruning treatments are of secondary importance. This statement needs no expounding.

Summarizing, I may say that we prune:

1. To modify the vigor of a plant;
2. To produce larger and better flowers and fruits;
3. To keep the plant within manageable shape and limits;
4. To change the habit of a plant from more or less wood bearing to flower and fruit bearing;
5. To remove superfluous or injured parts;
6. To facilitate spraying, cultivation and harvesting;
7. To add to the appearance of the plant;
8. To ward off fungous diseases;
9 To train the plant to some desired form;
10. To promote hardiness.

In all we prune to cause, augment, preserve, or discard some variable character or group of characters.

INSTRUCTIONS FOR SPRAYING.

(By W. H. Chandler Assistant Horticulturist, Missouri Agricultural Experiment Station, Columbia, Mo.)

If fruit is grown long in a country, insect enemies and fungous diseases generally become more numerous and it becomes necessary to combat them in some way, if orcharding is to be successful in that country.

The most successful method of combating the great majority of the orchard insects and diseases is by spraying.

In spraying for *insects that eat the surface of the leaves and fruit,* we generally use some form of arsenic as a poison. In spraying for the more common *diseases of the orchard,* we generally use copper sulphate with lime, making a mixture generally known as Bordeaux Mixture.

Spraying is an expensive process, but for successful orcharding in most sections it is absolutely essential. Professor Forbes of the Illinois Experiment Station has shown that spraying for one insect at a cost of seventeen cents per tree, will increase the profit from the orchard two and one-half times under their conditions. So while spraying is expensive it is nevertheless profitable where the insects and diseases are very prevalent. It may often make the difference between a good profit and no profit at all.

SPRAYING APPLES.

In an apple orchard insects that can be sprayed against and the ones that give the most trouble are the Codling Moth and Curculio. In the case of the Codling Moth the egg of the first brood is laid in the blossom end of the fruit and that of later broods may be deposited most anywhere on the fruit and in either case the worm that hatches out must eat its way into the fruit, beginning at the surface and will thus be killed if we have a poison on the surface which will be the first thing it eats. In the case of the Curculio, the adult eats into the fruit both for feeding and for the purpose of depositing its eggs. The adult early in the season feeds on the young leaves so that if a poison is on the leaves early, the adult will eat it and be killed.

The fungus diseases that are most largely to be found in the apple orchard, are Apple Scab and Bitter Rot. The apple scab is found as a scabby appearance on the leaves and fruit early in the season and is favored by cool wet weather. The bitter rot appears later in the season, causing often a serious rotting of the apples. It is favored by hot wet weather.

It is plain that when we spray for both Curculio and Codling Moth, the Apple Scab and these insects and diseases are prevented at the same time. So in most cases the following spray would be the remedy for Apple Scab and these two insects.

THE FIRST SPRAYING.

Just before the blooms open, but after the buds have unfolded and the whorl of leaves that come out behind the blooms are out.

This is a most important spraying for apple scab and helps to control curculio and may be a benefit for other insects, such as canker worm.

Use copper sulphate, four or five pounds; lime, four or five pounds; lead arsenate paste, two pounds; and water fifty gallons.

If there is no apple scab in the orchard and the orchard has not been troubled with it for a year or so previous, the copper sulphate and the lime may be omitted and only the lead arsenate paste used at this time.

SECOND SPRAYING.

Just after the bloom falls.

This is the most important spraying for codling moth and should be very thorough and the nozzle should be so adjusted that the spray can be forced downward strong enough so that it will penetrate and fill the blossom end of the fruit.

Use arsenate of lead, two pounds; water fifty gallons, and if there is apple scab present, use in addition, two pounds of copper sulphate and three pounds of lime.

THIRD SPRAYING.

The next spraying should be given in about fifteen days to three weeks, using the same mixture.

Other sprayings should be given if bitter rot and fruit blotch are present. In spraying for bitter rot use four pounds of copper sulphate and four pounds of lime to fifty gallons of water. It is also best to add two pounds of arsenate of lead for biting insects. The first spraying for bitter rot should be given about the middle of June, and if the orchard is badly infected, two other sprayings at intervals of about three weeks will be necessary.

SPRAY CALENDAR.

APPLE.—*Scab.* 1. Use strong Bordeaux mixture, containing five pounds of copper sulphate, five pounds of lime and fifty gallons of water, before the flower buds open. 2. Repeat just after the flowers fall. 3. If the orchard is badly infected, repeat at intervals of three weeks for two more sprayings.

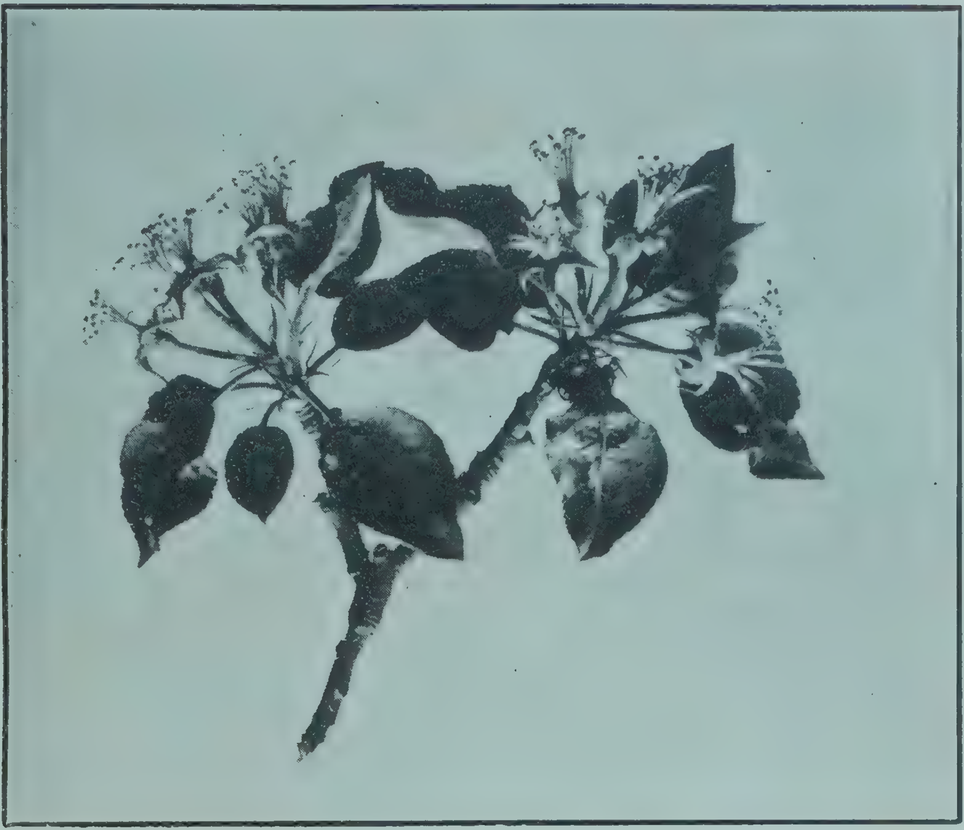


Figure 1. Apple blossoms at the proper stage for spraying for codling moth with arsenate of lead, using a Bordeaux nozzle which throws a strong coarse stream that will penetrate the cluster of stamens and fill up the calyx or flower cup. See page 316.

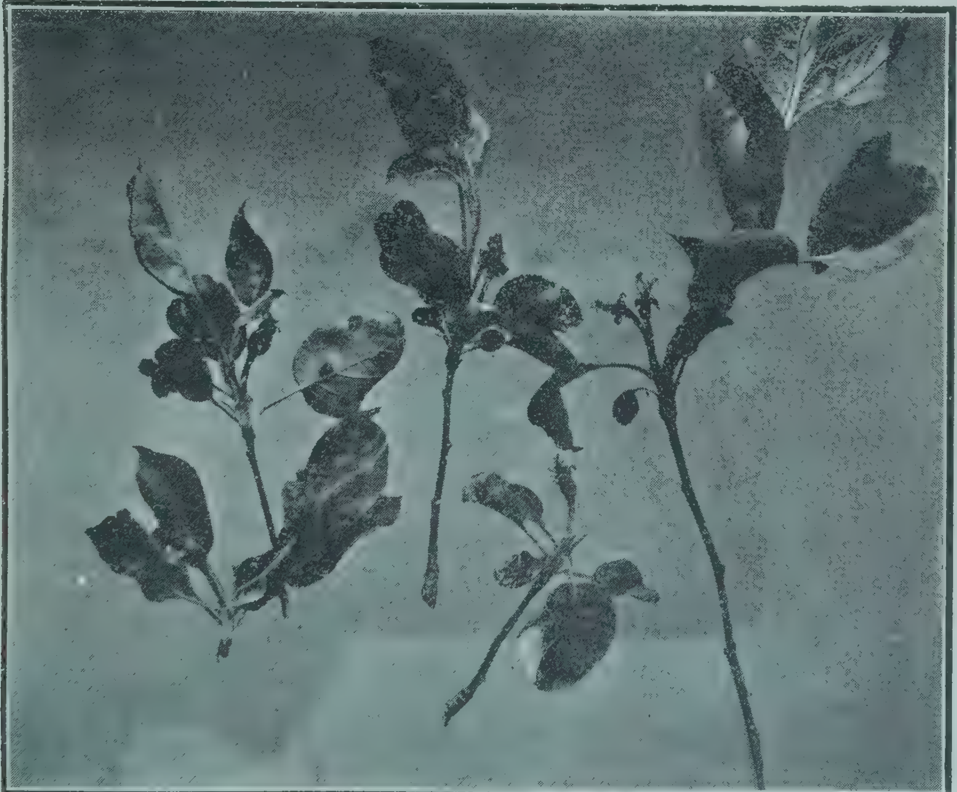


Figure 2. Apple scab attacks the leaves. The diseased foliage may be spotted as shown on the twig at the left of the picture, or the leaves may turn black and drop off.

Bitter Rot.—Use Bordeaux mixture, four pounds of copper sulphate and four pounds of lime in fifty gallons of water about the middle of June, or if it has not previously been serious, spray when the disease appears. Give two or three other sprayings at intervals of about three weeks.

Canker Worm, Codling Moth, Curculio and Other Biting Insects.—Use lead arsenate or other arsenical poison in the same kind of Bordeaux mixture recommended for the diseases.

Canker, Blight.—Cut out dead and diseased parts, apply sprays to large branches and trunks at each spraying.

San Jose Scale.—Use boiled lime-sulphur wash while the trees are dormant.

GRAPES.—*Black Rot, Downy Mildew, Biting Insects.* 1. Use Bordeaux mixture with arsenites before the flower buds open. 2. Repeat as soon as the flowers have fallen. 3. Repeat again at intervals of ten days or two weeks as may be needed.

PEACH.—*Brown Rot, Scab.*—Use unboiled lime-sulphur solution about four weeks after blooming—about a month before the fruit is ripe, and midway between these two seasons.

Leaf Curl.—Use Bordeaux mixture or lime-sulphur when the trees are dormant.

San Jose Scale.—Use boiled lime-sulphur wash or some miscible oil such as Scalicide when the trees are dormant.

Curculio.—It is possible to use lead arsenate in a weak solution, such as one to one and one-fourth pounds in fifty gallons of water, but this will sometimes cause the leaves to fall badly. Probably the safest remedy that is reasonably effective against curculio, is to cultivate the orchard during July and possibly through August. Of course the cultivation one year will help to keep the curculio in check the next year. This cultivation not only helps to keep the curculio in check, but by so doing also helps to keep down brown rot. A peach orchard in which curculio are bad should always be cultivated.

PEAR.—*Blight.*—Cut out all affected branches in the fall or winter, and repeat as often as necessary during the growing season. Cut several inches below the signs of the disease and burn all branches removed. Spraying will do no good whatever.

PEAR.—*Scab and Leaf Spot.*—See under Apple.

PLUM.—*Brown Rot.*—See under Peach.

PLUM.—*Black Knot.*—Cut out knots and burn. Spray as for brown rot.

Plum.—*Curculio.*—Some success from spraying with arsenites before the buds open and twice afterwards. Jar the trees for a period of a month after the fruit has set, at intervals of one to three days, catching the insects on a cloth and killing them.

Cherry.—*Leaf Spot.*—Self-boiled lime-sulphur about a month after blooming and just after fruit is picked.

Raspberry, Blackberry and Dewberry.—*Anthracnose.* 1. Cut out all affected canes in the spring and spray before the buds open with Bordeaux mixture. 2. Spray again at frequent intervals, using the same formula. As the fruit ripens use ammoniacal copper carbonate.

Orange Rust.—Prevent with Bordeaux mixture or some other fungicide. Plants attacked should be dug up and burned, as it is almost impossible to cure after once attacking a plant.

Strawberry.—*Mildew.*—Dust with sulphur at the first sign of the disease. Bordeaux mixture is equally effective.

Rust.—1. Apply Bordeaux mixture before the flowers open. 2. Ammoniacal copper carbonate before the fruit ripens. 3. After fruiting, apply Bordeaux mixture again as may be needed.

Potato.—*Blight, Rot and Beetle.*—Use Bordeaux mixture and lead arsenate when either appears and again at intervals of ten days as long as either is prevalent. The Bordeaux mixture is for the blight and rot and the lead arsenate is for the beetle, but generally both should be used.

Tomato.—*Blight and Rot.*—Bordeaux mixture when first fruit is half grown; Bordeaux again in ten to fifteen days. Ammoniacal copper carbonate should be used when the fruit is ripening, if any spraying is necessary at that time.

FUNGICIDES.

Bordeaux Mixture.

Copper sulphate (blue vitriol)	4 pounds
Quick lime	4 pounds
Water	50 gallons

Dissolve the copper sulphate by hanging it in a sack in a wooden tub of water so that the bottom of the sack just dips into the surface of the water. Hot water will dissolve the copper sulphate more rapidly. Slake the lime slowly so as to get it into as fine a powder as possible. Add twenty-five gallons of water to the

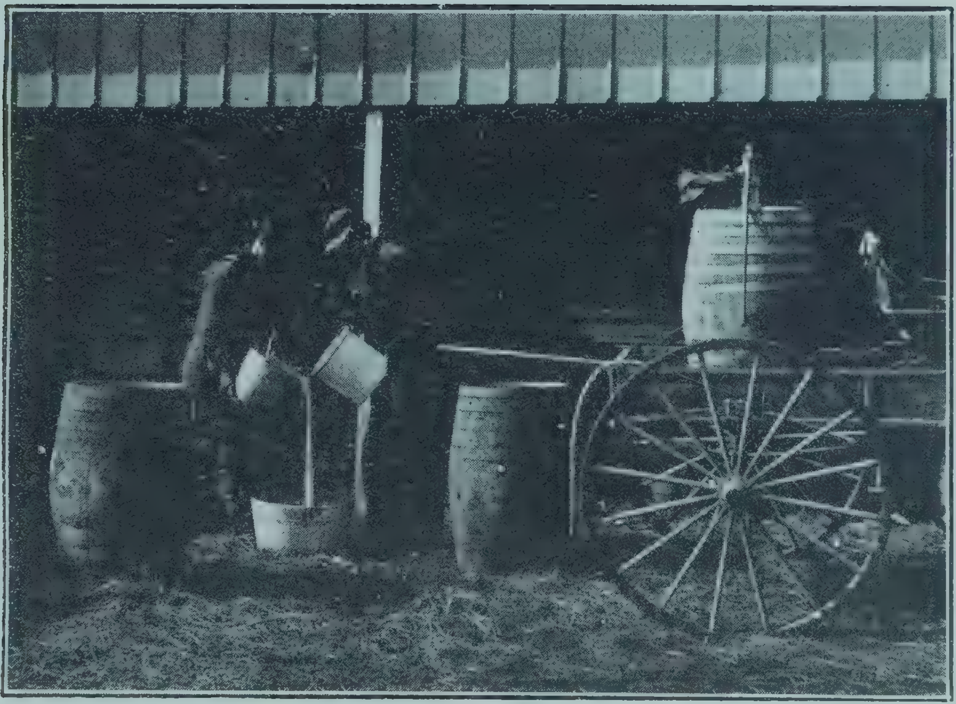


Figure 3. Small quantities of Bordeaux mixture may be made by pouring the two diluted materials together into a tub from buckets. See page 319.

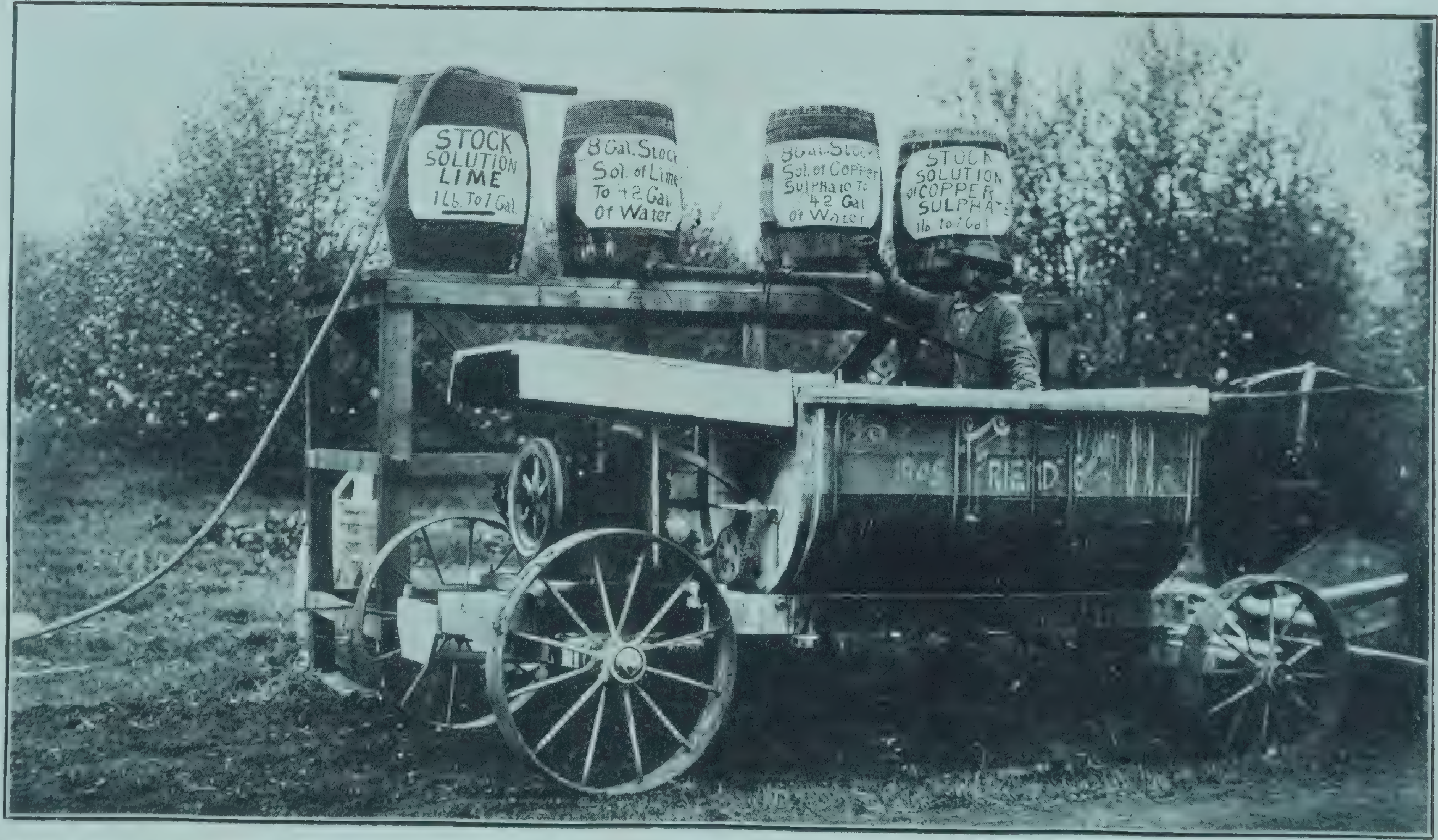

STOCK SOLUTION LIME 1 Lb. To 1 Gal.
8 Gal. Stock Sol. of Lime To 42 Gal. Of Water.
8 Gal. Stock Sol. of Copper Sulphate To 42 Gal Of Water
STOCK SOLUTION of COPPER SULPHATE 1 lb to 1 Gal
FRIEND

Figure 4. Convenient plan for mixing fairly large quantities of Bordeau mixture. The middle two barrels are connected with pipes which come together, and thus the two mixtures are easily combined before passing into the spray tank.

lime, dilute the copper sulphate to twenty-five gallons, then pour the two liquids at the same time into the spray barrel or tank. This is a very important step in making Bordeaux mixture and is the one most frequently neglected. The accompanying illustrations show how the mixing is done on both a large and a small scale. In making up this formula, if the two materials are mixed in a concentrated form the solid particles in the mixture will not stay in suspension well. This will result in an unequal distribution in spraying, the first of the mixture being stronger than the last.

In making up considerable quantities of Bordeaux mixture, it is convenient to have the mixing tank elevated so that the prepared mixtures may be drawn into the spray tank without the necessity of dipping or lifting. In Fig. 4 is shown such an arrangement. The barrels in the center contain the diluted copper sulphate and milk of lime, which may be run together and mixed as they flow through the pipe connecting them and into the tank. The barrels on either side of the center pair contain the stock solutions of copper sulphate and lime. The stock solution of copper sulphate is made by dissolving the crystals in water at the rate of one pound to the gallon, or fifty pounds in fifty gallons of water. It is best to suspend a sack of the crystals in the top of a barrel of water. To make up a tank of fifty gallons of Bordeaux mixture, four gallons of this stock solution would be used.

Slake a weighed quantity of fresh stone lime in the usual manner by sprinkling with just sufficient water so that it will crumble into a fine dust. The stock solution of lime is made up by adding enough water to the lime powder so that each gallon will contain one pound of lime. In making up the dilute solution for mixing in a 50-gallon spray tank, take four gallons of the stock solution of copper sulphate, four gallons of the *well-stirred* milk of lime, each being poured into its respective barrel. Twenty-one gallons of water are then added to the copper sulphate barrel; twenty-one gallons of water added to the lime barrel and each barrel then marked exactly and plainly the height of the solution in it. In mixing future amounts it is then necessary to measure only the stock solutions, and add water until the barrels are filled to the mark made in the first filling. Since Bordeaux mixture is not efficient for a great length of time after it is made, it is necessary to make up only the amount which is needed to fill the tank or which can be used that day. Arsenate of lead should be added for biting insects.

Self-Boiled Lime-Sulphur Wash:

Sulphur	10 pounds.
Lime	10 pounds.
Water	50 gallons.

Place the lime in a barrel and pour on enough water to start it slaking and to keep the sulphur off the bottom of the barrel. Then add the sulphur, which should first be worked through a sieve to break up the lumps, and finally pour in enough water to slake the lime into a paste. Considerable stirring is necessary to prevent caking on the bottom. After the violent boiling which accompanies the slaking of the lime is over, the mixture should be diluted ready for spraying, or at least enough cold water added to stop the cooking. Five to fifteen minutes are required for the process, according to whether the lime is quick acting or sluggish. The intense heat seems to break up the particles of sulphur into about the physical condition of precipitated sulphur, and the violent boiling makes a good mechanical mixture of the lime and sulphur. Only a small percentage of the sulphur—enough to improve the adhesiveness of the mixture—goes into the solution, but if the hot mass is allowed to stand as a thick paste the sulphur continues to unite with the lime, and at the end of thirty or forty minutes enough of the reddish liquid is produced to burn peach foliage, and even apple foliage, in some cases. Hence the necessity for cooling the mixture as soon as the lime is well slaked.

The mixture should be strained through a sieve of 20 meshes to the inch in order to remove the coarse particles of lime, but all the sulphur should be worked through the strainer.

The directions for making this mixture were taken from Circular of Information No. 27, Bureau of Plant Industry, Department of Agriculture, Washington, D. C., by Professor W. M. Scott. It has been found by Professor Scott that this mixture will not injure the foliage of peaches, plums and cherries, and can be used to spray for peach scab and brown rot, and also for the leaf spot on cherries to good advantage.

Ammoniacal Copper Carbonate:

Copper carbonate	6 ounces.
Strong ammonia (just enough to dissolve the carbonate) about	3 pints.
Water to make	50 gallons.

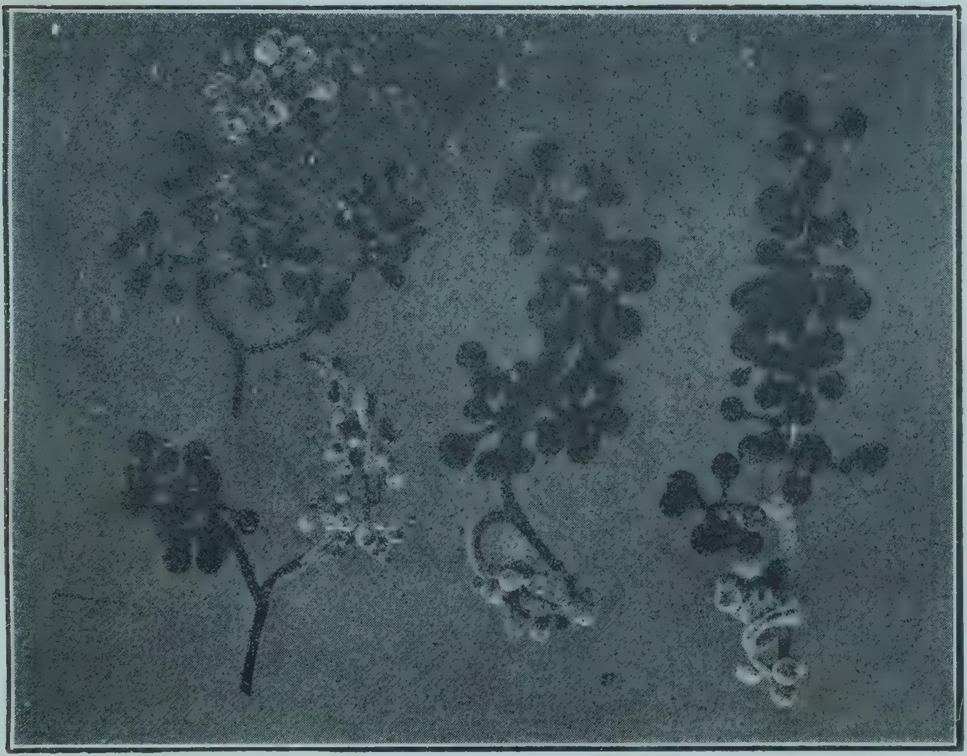


Figure 5. Clusters of young grapes affected by Downy Mildew.

Dissolve the copper carbonate in the ammonia, using no more of the ammonia than will barely dissolve the copper carbonate. When all is in solution, add fifty gallons of water and it is ready for use. This is for use only when the fruit is ripe, or nearly so, and we do not wish to discolor it with Bordeaux mixture.

FORMALIN SOLUTION.

For Potato Scab:

Formalin	1 pint.
Water	30 gallons

Soak the potatoes in this solution for about two hours before cutting into pieces for planting.

FOR GRAIN SMUT.

Mix one pint of commercial formalin (40 per cent strength) with fifty gallons of water in a large tub, or barrel. Pour the grain to be treated on a floor and sprinkle with the solution from a sprinkling can until the surface of every kernel is thoroughly moistened; allow to stand in the pile ten minutes, then spread out in a thin layer in an airy place to dry, shoveling over occasionally to hasten the drying process.

Another method of using this solution is to place the grain in gunny sacks and immerse in the liquid for ten minutes, taking care to see that the solution penetrates to the center of the mass. Hang up and allow to drain for five or ten minutes, then spread out and dry.

This method is entirely effective for smuts of both oats and wheat.

INSECTICIDES.

Paris Green:

Paris green	1 pound.
Quick lime	3 pounds.
Water	100 to 175 gallons.

This insecticide is for *biting insects* only. It may be applied along with Bordeaux mixture, in which case the Bordeaux mixture is considered as so much water and the Paris green and lime added to it in the above proportions. The Paris green will mix with the water more readily if mixed with the lime after slaking and before putting into the spray tank. If added dry to the water, it is apt to float around on top of the liquid. It is thought to be the best insecticide to use with the lime sulphur wash.

Arsenate of Lead:

Lead acetate	24 ounces.
Arsenate of soda	8 ounces
Water	100 gallons.

Use only the very best chemicals in making this preparation. Dissolve each of the materials in a separate bucket half full of water. After both are thoroughly dissolved, pour them together into another bucket and allow the mixture to stand for a few hours. A white precipitate or sediment is formed, which is the arsenate of lead. All of the bucketful should be added to a spray tank containing one hundred gallons of water, and it is then ready for use.

Arsenate of lead is one of the best insecticides to use for biting insects. It is less liable to injure the foliage than Paris green, sticks very well, and its white color shows very plainly where it has been applied.

Arsenate of lead is handled by dealers in spraying supplies as a commercial article, under the name of "Disparene." In large quantities it can be made more cheaply than bought in this form, but where only a small amount is needed Disparene is the cheaper Two pounds of Disparene should be used in fifty gallons of water.

Besides Disparene (Bowker Chemical Co.), a number of companies have a good grade of arsenate of lead paste on the market, viz., the Swift's, Sherwin-Williams, Henry Heil, and others. Only high grades of lead arsenate should be used and each package should bear a statement and guarantee of the analysis.

Hellebore:

Fresh powdered white hellebore	1 ounce.
Water	3 gallons.

Apply when thoroughly mixed. Hellebore is used when it is not advisable to use arsenates on account of the tender foliage or proximity to the ripening period.

Kerosene Emulsion:

Kerosene (coal oil)	2 gallons.
Hard soap	½ pound.
Water (soft)	1 gallon.

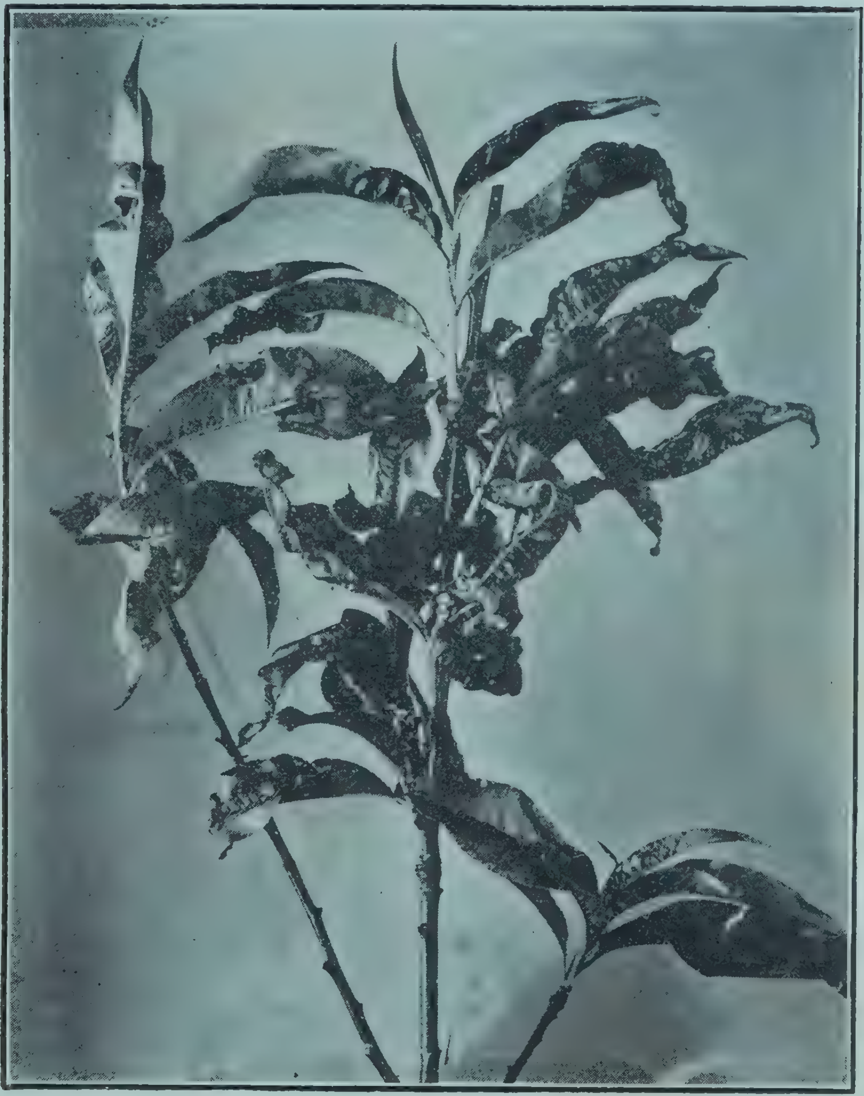


Figure 6. Peach leaves distorted by the Peach Leaf Curl.

Dissolve the soap in boiling soft water, adding the kerosene as soon as all of the soap is dissolved. Mix by pumping back into the tub with the spray pump for fully ten minutes. A thick, creamy emulsion is formed from which the oil does not readily separate. For use mix this emulsion with nineteen gallons of water. If the stock emulsion has become cold it may be necessary to soften it up so as to mix more freely with the water by using some hot water. This is especially valuable in fighting plant lice and other soft-bodied insects which suck the juices of plants.

Hydrocyanic Acid Gas:

Fused cyanide of potassium (98 per cent pure)	1 ounce.
Sulphuric acid (concentrated)	2 ounces.
Water	4 ounces.

This is sufficient for one thousand cubic feet of space, and exposure to it should not be made for longer than one hour. Fumigating with this gas must be done in a tight box or room to secure efficiency against insects and to protect other plants, animals and men from injury. *This gas is very poisonous and must not be inhaled for even a moment.*

Empty the water into a glass vessel and pour the acid slowly into this. After weighing out the proper amount of potassium cyanide tie it up in a cloth sack just large enough to hold it. An old tobacco sack is just right. Place the jar of acid where it is wanted. Drop into it the sack of cyanide and quickly close the box or run out of the room, shutting the door tightly behind you. This gas is especially useful in greenhouse and nursery fumigation. No insect can withstand thorough fumigation with it.

Tobacco Tea:

Tobacco stems	1 pound.
Water	3 gallons.

Boil the stems for a few minutes and pour off the liquid. Add enough water to make up the three gallons. The value of this tea may be increased by adding one pound of whale-oil soap to each fifty gallons of the liquid. Valuable in controlling plant lice and woolly aphis.

Lime-Sulphur, Boiled:

Lime	15 pounds.
Sulphur	15 pounds.
Water	50 gallons.

Slake the lime to a fine, thin paste, add water to the sulphur until it becomes a paste, mix well with the lime and stir the entire mass until all are well mixed. Add sufficient water to make up to a thin, white, wash. Bring the mass to the boiling point and allow it to boil vigorously for one hour. Add enough water to bring up to fifty gallons, strain as it is poured into the spray tank and apply while hot. The color will have changed in the boiling to a deep yellowish or brownish green. This artificially boiled mixture cannot be used when the foliage is on the trees.

Pyrethrum:

Fresh pyrethrum powder	1 part.
Flour	2 to 3 parts.

This is very poisonous to insects when perfectly fresh, and is very useful in combating lice on plants or poultry. It is not poisonous to man or animals.

Carbon Bisulphide:

Very effective against root infesting insects and those in stored grain. Inject a small quantity around the roots of the infested plants, or place a quantity on top of the seed. The fumes are heavier than the air and settle through the soil or bins of seed. It ignites very easily and must be protected from fire. Two pounds of bisulphide of carbon should be used for every one thousand cubic feet of bin space, regardless of the amount of seed in it.

DUST SPRAYING.

Anyone interested in Dust Spraying should see Bulletin No. 19, Missouri State Fruit Experiment Station, Mountain Grove, Mo., by F. W. Faurot, and Bulletin No. 106, of the Illinois Experiment Station, Urbana, Illinois, by Charles S. Crandall. The results of both of these gentlemen's experiments indicate that Dust Spraying is so much less efficient in controlling insects and especially diseases of the orchard, that it is seldom, if ever, to be recommended.

INDEX.

Page

- Acreage 85, 92, 225
- A Missouri fruit show 12
- A visit to the Georgia Peach District 108
- Address of welcome at Mountain Grove
  - By Mayor Candler 26
  - By Frank Horsfall of the Wright County Horticultural Society 27
  - Response by Mr. Dutcher 27
- Agricultural Science, Journal of 292
- Air drainage 61
- American Breeders' Association, proceedings of 289
- Ammoniacal copper carbonate 318, 320
- Anthracnose 318
- Apple blotch 287
  - Canker 317
  - Curculio 187, 315–7
- Apple day at the State Fair 53
- Apple scab 315, 316
- Apple shows, Columbia 245
  - Council Bluffs 221
  - Spokane 221
  - For Missouri 12
- Apple trees, number in Missouri 147
  - In the United States 142
- Apples, bitter rot of 287
  - Canning of 210
  - Clean cultivation of orchards 165
  - Crab 153–4
  - Cultivation of orchards 262-3
  - Diseases of 263, 42, 87, 315–7
  - Dishonest methods of packing in Canada 133
  - Grades of 138–9
  - Insects affecting 187, 315–7
  - New vs. old methods of picking and packing 132
  - Originated in Missouri 297
  - Packing and shipping 168
  - Picking and packing 264–5
    - New vs. old methods of 132
  - Planting 259
  - Previous preparation of land 257–8
  - Prices of 141
  - Production of 141–2
  - Pruning 259–262
  - Rules for picking 136
  - Selecting trees 258
  - Self-fertility of 43
  - Selling price for canning purposes 212
  - Sizes for packing 137
  - Soil and location of orchards 254

Page

- Apples, spraying of 315–7
  - Training of trees 259, 260, 262
  - Varieties 141, 144–5, 153–4, 169, 170, 173, 255–6, 264–5, 315–7
    - For commercial orchards 255–6
  - When and what to spray with 316–7
  - Wiping and sorting of 137
- Apricots 212
  - Canning of 210
- Arbor Day—Its significance and observance 149
- Arbor Day, history of 149
- Arsenate of lead 191, 198, 322
- Arsenite of lime 191
- Asparagus, cost of canning 212
  - For canning 209
  - Selling price for canning purposes 213
- Auditing Committee, reports of 21, 22
- Awards, report of Committee on 245
- Beans, cans for 205
  - Lima, canning of 211
  - String, cost of canning 212
  - String, selling price for canning purposes 213
- Beets, canning of 212
- Berries, cans for 205
  - Best varieties of strawberries 87
  - Canning of 209
- Bitter rot 287, 315–7
  - Of apple 287
- Blackberry, Anthacnose 318
  - Growing of 207
- Black knot of cherry 19
  - Of plum 19
- "Black-Leaf Extract" of tobacco for wooly aphis 190
- Black rot of grape 287
- Blair, Prof. J. C. 145
- Blight canker 288
- Blight of pears 317
  - Of potato 318
- Blossoms, hardiness of 123
- Board of Horticulture, officers & members 2
- Bone meal for orchards 221
- Bordeaux 63, 78, 54, 263, 287, 315–319, 321
- Boys on the farm 240
- Brief history of the canning and preserving industry 202
- Brown rot 64, 109, 317
  - Treatment of 65
- Brown tail moth 19
- Bud growth, retarding of and cutting back 117

Page
Buds, table showing formation of........ 122
Bud variations........ 242
Bureau of Plant Industry......287, 290, 292, 295, 320
Cabbage, black rot........ 291
  Club root........ 288
Candler, Mayor........48, 61, 78
Canker worm........ 317
Canned fruits and vegetables, profits of...205-7
Canners, details of operating........207-12
Canners, home, general information on.... 212
Canning outfits, cost of........204, 205
Canning fruits and vegetables, necessity for........ 202
Canning industry, brief history of........ 202
Cantaloupes, Pollock strain of Rockyfords. 289
  Growing of........ 232
  Methods of planting........ 232
  Seeds........ 233
  Shipping........ 234
  Varieties........ 232
Carbon disulphide........ 324
Carlot shipments........ 39
Catalpa growing........277-8
Chandler, W. H....113, 131, 152, 313, 319
Cherries, canning of........ 209
  Selling price for canning purposes...... 212
Cherry leaf spot........ 318
Christian, J. H.....222, 228, 229, 230, 231
Citron, crossed with watermelon........ 292
Clover, red........ 289
Codling moth, spraying for.....187, 188, ...198, 250, 315, 317
Coffee........ 291
Coldframes, hotbeds, etc........266-275
Cold periods following warm periods...... 115
  When the buds are thoroughly dormant. 114
Cold storage........ 111
Colorado Agricultural Experiment Station. 286, 289
Committees, reports of, Auditing........21, 22
  Awards........ 245
  Obituary........ 248
  Premium........ 248
Co-operation........84, 191
  Among fruit growers........ 42
  In spraying........ 76
Co-operative work with, Ozark Fruit Growers' Association........ 8
  College of Agriculture........ 8
  State Board of Agriculture........ 8
  Station........ 7
Corn, canning of........ 211
  Cans for........ 205
  Cost of canning........ 212
  Crops, weeds of........ 216
  Selling price for canning purposes...... 213
Cornell University Agricultural Experiment Station........ 288
Cost of canning outfits........204-5
Cotton, wilt fungus of........ 290
Coutant, Louis........ 290
Cover crops, orchard........215-221
Cowpeas for orchards........ 218
  Susceptible to wilt........ 292
Cox, Mrs. S. T........173, 231
Creation of new markets........ 39
Crop conditions, report of........ 38
Cross pollination........43-59
  Pears........ 43
  Temperature........ 45
  Insects........ 45
  Time of blooming........45-6
Crown gall........19, 69
  Treatment of........ 70
Crude oil for orchard heating........ 173
Culp, C........108, 172, 173, 197, 229
Cultivation as an end to late growth.....80, 81
  And fertilizing........ 82
  Effect of, on hardiness of peaches...... 127
Currants, canning of........ 210
  Selling price for canning purposes...... 212
Curculio, apple........187, 188, 199
  Of plum........ 318
Cutting back peach trees........ 127
Darsche, J. H.....131, 156, 172-3, 183, ...184, 201
Dearing, Charles........ 302
Delicious apple, origination of........ 244
Demonstration work........ 9
Determination of shipping qualities...... 36
Development of disease-resistant plants. 284-296
Dewberry anthracnose........ 318
Die-back........66-68
  Treatment of........ 68
Diseased buds........56, 57
Disease of neglected peach trees........278-83
  resistant plants........288-296
Diseases of trees........ 296
Disparene........ 322
Division of vegetable physiology and pathology........287, 290, 291
Dormant period, relation of pruning to.... 177
Downy mildew of grape........ 291
Dunlap, H. M....43, 46, 47, 48, 58, 78, 80, ...81, 82, 84-5, 92
Dust spraying........ 324
Dutcher, C. H..27, 57, 81, 82, 92, 131, 156, 213
Elevation of Missouri........ 147
  Maryland, Massachusetts, Illinois, Pennsylvania, New York........ 147
  Of the Ozark region........ 158
Emerson, Prof. R. A........132, 152, 156
Erb, Louis........36, 46, 58, 61, 96
Erickson, W........ 294
Evans, Col. J. C........37, 87, 95, 248
Evans, Paul........33, 36, 37, 80
Exchanges........ 5
Expense between grower and consumer... 40
Experimental testing work........ 11
Facts about Wright County........ 28
Farm Canner, The........203-4
Farmers' Bulletins, U. S. Department of Agriculture........ 287
Farmers' Week........9, 98
Fertilization of grapes........ 300
Fertilizers........52, 110
Fillers........ 47
Flax wilt........ 289
Flournoy, W. T........ 48
Forbes, Prof........ 315
Forbes Scale........ 187
Forest regions in Missouri........ 158
Fires, prevention of........ 160

Page
Forest Service, U. S. Department of...... 161
Forestry Commission.................. 162
Forestry, present policy of in Missouri.... 161
  Proposed policy..................... 161
  Missouri's opportunities in............ 156
  Missouri's timber resources...........275-8
  Trees, Black Walnut................ 153
    Catalpa.........................277-8
Forest service, U. S.................. 161
Formalin solution..................... 321
Frauds and nostrums.................. 11
Freight rates......................... 8
Frost protection...................... 167
Frosty mildew........................ 69
  Treatment of........................ 69
Fruit exhibit......................... 8
Fruit Experiment Station, variety tests... 29
Fruit farm managers.................. 86
Fruit grower, The... ....218, 219
Fruit growing in the west and northwest.
 163-174
  Inspection in Idaho................ 112
  Rate injunction..................... 39
  Rates............................. 39
  Sales of the northwest.............. 164
  Show in Missouri................... 12
  Situation.......................... 54
Fungicide...........................318-21
Fungus diseases and pruning........... 175
Galloway, B. F........................ 285
Genesee Valley, N. Y., cover crop at...... 220
Georgia peaches...................... 108
Gipsy moth.......................... 19
Glassmire, C. L....................172, 174
Gooseberries, selling price for canning
  purposes........................... 213
Grading apples......................138-9
Grain smut, remedy for................ 321
Grand Junction, Colo., orchards at....... 167
  Small farms at..................... 215
Grapes...........................297, 298
Grapes, ashes as a fertilizer for......... 184
  Bagging as a protection from rot....... 180
  Black rot of....................... 317
  Canning of........................ 210
  Cost of spraying................... 287
  Diseases of........................ 317
  Downy mildew...................... 317
  Growing of........................ 302
  How to grow and care for............ 179
  Sales for.......................... 179
  Selling price for canning purposes...... 213
  Summer pruning of................. 180
  Trellises.......................... 180
  Varieties...............180-4, 300-1, 305
  When to plant...................... 179
  Phylloxera......................... 291
Grass mildew........................ 293
Green apple ahpis..................... 190
Green peach aphis.................... 190
Growing cantaloupes in Colorado as seen by
  a Missourian........................ 232
Growing tomatoes for canning purposes... 48
Haldeman, J. R.................46, 53, 57
Hardiness of peach buds, blossoms and young
  fruits as influenced by the care of the
  orchard............................ 113

Page
Hardiness of varieties of peaches......... 129
  Relation of pruning to............... 177
Hardy buds, location of, on the twigs.... 121
Hardy peaches........................77-82
Hairy vetch for orchards............... 218
Heading back............115, 117, 121, 122
Hellebore............................ 322
Hitt, R. M....77, 78, 79, 80, 96, 108, 111,
  ....112, 232, 249
Hodge, Mrs. E. H....................80, 92
Holsinger, Major Frank.....108, 183, 200,
  ....228, 229, 230-1
Home canners, general information on.... 212
Horsfall, Frank....................27, 56-7
Horticultural delegates.................6, 96
Horticultural developement for Mo.....145-149
Horticultural districts, map of........... 1
Horticulture in the rural schools......... 9
Hotbeds............................. 50
Hotbeds and cold frames, uses of.......269-70
Hotbeds, cost of making............... 268
  Crops for summer..................273-4
  Planting and management...........270-2
  Ventilation and watering............272-3
Howard scale......................... 190
Howard, W. L......13, 58, 80, 78, 111,
  ....118, 235, 266, 275
How can farmers be influenced to beautify
  their homes........................ 88
How the fruit grower deals with the insect problem in Colorado...........185-192
How to grow and care for grapes......... 179
How the insect situation is handled in
  Illinois............................ 192
How to can fruits and vegetables on the
  farm.............................. 202
How to reach the unsupplied markets..... 38
Hybrids of rye an wdheat.............293-295
Hydrocyanic acid gas.................. 323
Illinois Agricultural Experiment Station...
  .... 287, 315, 324
Impressions of the orchards and orchard
  districts of the west................ 235
Improved varieties.................... 240
Influence of music in the home.......... 31
Insecticides......................... 72
Insecticides, arsenate of lead.....187, 321-24
  Scalecide, Kill-O-Scale, Target Brand
  Scale Destroyer.................... 318
Insect pests......................... 54
Insect problems, how dealt with in Colorado
 185,192
Insects, spraying against............... 187
  Control of......................... 197
  Most damaging..................... 197
Inspection, endorsement of fruit growers.. 18
  Forestry.......................... 196
  In Colorado........................ 191
  Laws.............................200-1
  Nursery.........................193,195
  Nursery and orchard................ 18
  Orchards........................192, 194
  Osage orange...................... 197
  Proposed legislation................18-20
Inspection work....................... 30
Intensive farming..................... 215
Irrigation........................229, 236

Page
Irvine, J. M......95, 103, 112, 183-4, 215, 219, 230
Keller, Kate......172, 173
Kerosene emulsion......189, 322
Kingsbury, R. T......172, 173
Kraut, canning of...... 212
Large vs. small orchards...... 82
Late cultivation...... 62
Lead arsenate...... 318
Leading insect problems of the year, the... 197
Leaf curl, treatment of......65, 66
Letter of transmittal...... 3
Library...... 12
Lime-sulphur, boiled...... 324
  For spraying...... 173
  Home made for insects...... 199
  Unboiled for brown rot......317, 318
Lime sulphur wash......64, 72, 73, 190, 198
Living brace...... 105
Local horticultural organizations...... 9
  Visits to...... 8
Louisiana Agricultural Experiment Station...... 206
MacKesson, Mrs. Virginia F...... 149
Mailing list...... 5
Marketing apples, new vs. old methods of...... 132
Marketing peaches...... 111
Marketing Missouri fruit...... 299
May freeze of 1908...... 4
Melon growing...... 297
Mendel's law of inheritance...... 292
Methods, conditions and future prospects of the fruit districts of the west, compared with Missouri and sister states.... 163
  Mildew, strawberry...... 318
Miller, Chas. G......183, 184, 201
Minimum temperatures in Missouri...... 119
Miscellaneous papers...... 253
Miscible oils......72, 199
  Names of...... 200
Mississippi bottoms, dense stands of timber in...... 161
Missouri—
  Agricultural Experiment Station...304, 306, 313
  Apple growing in......254, 266
  Elevation of...... 147
  Fruit Experiment Station......278-9, 324
  Fruit show...... 12
  Horticulture in...... 296
  Orchards in...... 239
  Population of...... 148
  Railroads of......147-8
  Rainfall...... 147
  Timber supply of......277-8
  Transportation facilities......147-8
  Opportunities in forestry...... 156
  Rank in the timber industry...... 157
Moles...... 230
Moore, Mrs. A. Z......87, 90, 92
Moore, L. N......213-4
Moore, Mrs. M. E...... 202
Murray, Nicholas F......95, 248, 249
National pure food law...... 203
Nebraska Experiment Station......153, 155
Necessity for canning fruits & vegetables... 202
Necessity for spraying...... 53
Nectarines, selling price for canning purposes...... 213
Nemetode...... 292
New Jersey Agricultural Exp't Station... 288
New peach scale...... 19
New varieties of strawberries...... 33
  Discussion of...... 36
New vs. old methods of picking and packing apples...... 132
New York Agricultural Experiment Station......278, 288
Nitrate of soda...... 82
Number of counties infested with San Jose scale...... 76
Obituary...... 248
Oat rust, losses due to...... 285
Oat smut...... 288
Office furniture...... 12
Office of the Secretary...... 7
Ohio Experiment Station...... 287
Oil, crude, for heating orchards...... 173
  Cost of...... 173
  Miscible, for spraying...... 173
Okra, canning of...... 211
  Cost of canning...... 211
  Selling price of canned product...... 213
Old associations...... 5
Onion smut...... 288
Ontario Agricultural College and Experimental Farm...... 290
Opportunities in the Ozarks...... 26
Orange rust of berries...... 318
Orchard cover crops......215-221
  In the west......219, 220
  Literature...... 216
Orchards, culture of...... 218
  Fertilizer...... 216
  Of the northwest...... 235
  Protection...... 167
Orchard survey...... 5
Organization......41, 42
Ornamental planting...... 88
Ornamental shrubs...... 89
Ozarks, commercial forests in the...... 159
  Fruit and truck raising in the...... 203
  Opportunities in the...... 26
Packing, dishonest methods of, in Canada.. 133
  Sizes of apples for...... 137
Packing fruit...... 110
Packing and marketing apples, new vs. old methods of...... 132
Palisade, Colorado, small farms at...... 215
Paris green...... 321
Paynter, W. C......59, 61, 80, 82, 125
Peach curculio...... 317
Peaches, brown rot of...... 317
  Canning of...... 210
  Cost of planting...... 59
  Diseases of......19, 278-83, 285, 287, 317
  Laws for...... 205
  Losses due to leaf-curl in United States.. 285
  Peach districts...... 60
  Planting...... 59
  Selling price for canning purposes...... 213
  Varieties of......279, 280, 313, 314
Peach growing...... 59

Page
Peach leaf curl 287, 317
Peach rosette 19
Peach scab 317
Peach twig borers 190
Peach yellows 19
Pear blight 288, 317
Pear mites 190
Pear scab 317
Pears, canning of 210
  Cost of cans 212
  Disease of 190, 317
  Leaf spot of 317
  Selling price for canning purposes 213
  Varieties 291, 305
Peas, canning of 209
Phylloxera of grape 291
Picking apples, rules for 136
Picking, packing and marketing, new vs. old methods of 132
Pineapples, prices paid for canning purposes 213
Plant diseases, estimated losses due to 285
Plums, black knot of 317
  Brown rot 317
  Canning of 210
  Curculio 318
  Rosette 19
  Selling price for canning purposes 213
  Varieties 152, 277, 299
Pollock strain of cantaloupes 289
Potato beetle 318
  Blight 318
  Late blight 290
  Losses due to late blight in New York 285
  Resistant to blight 295-6
    To rot 290
  Rot 318
  Scab, remedy for 321
Pots, oil, number per acre 174
  For burning oil in orchards 173
Powdery mildew 69
  Treatment 69
Powdery mildew of roses 292
Prairie regions 160
Precooling 112, 113
  Process of 220
Premiums awarded 245, 248
Premium list 101-3
Printing annual report, funds for 10
Proceedings Cambridge Philosophical Society 296
Proposed new work for the next two years 9-13
Profits from canned fruits and vegetables 205, 206, 207
Protection from frost 167
Pruning 103, 114
Pruning, apples 260, 261, 262
  According to the individual tree 177
  Fundamental principles of 302-14
  Fungus diseases and 175
  In different sections 175
  Of the grape 301
  Open head 104
  Peach 110
  Reasons for 314
  Relation of dormant period to 177
  Relation of hardiness to 177

Pruning, apples—Continued. Page
  Reproductive activity and 176
  To check growth 308
  Vegetable activity and 176
  Why we prune 174-178
  Wounds of 236
Pumpkin, canning of 211
  Cost of canning 212
  Selling price for canning purposes 213
Pure food law 203
Pyrethrum 324
Quince, selling price for canning purposes 213
Rabbits, wrappers to protect from 264
Rainfall of Missouri 297
Raspberries, canning of 209
  Selling price for canning purposes 213
Raspberry, Anthracnose 318
Recent work against the San Jose scale in Missouri 70
Record, Samuel J 156
Red clover 289
Reed, George M 284
Relation of early maturity to hardiness in trees 152-6
  Hardiness to pruning 177
  Dormant period to pruning 177
Reports, Auditing Committee 21, 22
  Committee on awards 95, 249
  Final Resolutions 96
    Obituary 95
  On Crop Conditions 38
  Secretary, Financial 14-16
    General 4
  Treasurer 21, 22
Resting period of buds 116, 118, 121, 122
Rest period in peach propagation 62, 80-1
Riehl, E. A 108, 179, 183-4, 234
Rogers, A 230
Rolfs, F. M 63, 79, 80, 278
Root pruning 305
Root rot 70
Roses, climbing 90
  Hybrid, perpetual 292
  Powdery mildew of 292
Rosette of the peach 68
Royal Horticultural Society, Journal of 304, 311
Royer, J. A 112, 231
Rural school work 7
Rust of strawberry 318
Rye and wheat hybrids 293-295
Rye as an orchard cover crop 219
Rye and wheat hybrid, immune to wheat mildew 294
San Jose scale 19, 112, 113, 142, 143, 187, 190, 192-3, 195, 198-9, 201, 237, 317
  Co-operative fight against 76
  Counties infested 76
  Essentials of a scale law 71
  First infestation 71
  In Georgia 109
  Legislation of 1899 71
  Lime-sulphur wash 73
  Recent work against 70
Scab, apple 315-6
Scab, treatment 66
Schnabel, John 214
School gardening 11, 89, 90

Page
Science.................................. 292
Secretary's financial report, G. T. Tippin..13-14
  W. L. Howard....................15-17
  Office.............................. 7
  Report.............................. 4
Selection of peach buds for budding...... 56
Self-boiled lime-sulphur mixture...63, 79, 320
Self pollination........................ 36
Shade trees, varieties of...............88, 89
Shrubs, varieties....................... 93
Size of orchards........................ 83
Small fruits, yield of 1908.............. 4
Small orchards.........................6, 91
Smudging orchards....................... 167
Smuts, formalin treatment............... 288
Soils................................... 51
  Loess................................. 298
Some of the most desirable shrubs, climbers and plants for decorating the home grounds................ 93
Some thoughts on Plant Breeding......... 239
Spanish peanuts as an orchard cover crop. 219
Spokane apple show..................... 221
Spray calendar.........................316-8
Spraying...........................191, 236
  Apples................................ 315
  Arsenate of lead...................... 55
  Bordeaux........ 54, 63, 78, 263, 287, ...315-9, 321
  Co-operative work.....................75-6
  Demonstrations........................ 74
  Dust.................................. 54
  Dust method........................... 324
  For scale and aphis................... 165
  For late growth......................78-81
  Instructions for....................314-324
  Necessity for......................... 53
  Nozzles............................... 263
  Paris Green........................... 55
  Time for.............................. 316
Spring frosts........................... 61
Spring frosts after fruit has set........ 124
Spring frosts at blooming time......122, 124
  In Colorado........................... 174
Squash, canning of...................... 211
  Cost of canning....................... 212
  Selling price for canning purposes...... 213
Stark, W. P .... 47, 57-8, 79, 81-2, 90, ... 111-2, 131, 156, 175
Stedman, J. M.....................197, 200
Stinson, J. T........................... 53
Strawberries, acreage................... 225
  Aroma...........................225, 229
  Associations.......................... 223
  Brandywine......................231, 232
  Budding and dry weather............... 228
  Buttoning.......................228, 231
  Canning of............................ 209
  Crosses............................... 34
  Cultivation........................... 226
  Frost at Mountain Grove............... 34
  Gandy...........................224, 228
  Hill culture...............222, 226, 230
  Late frosts........................... 224
  Mildew................................ 318
  Opportunities for growers............. 37
  Precooling............................ 227

Strawberries—Continued. Pag
  Profits in growing in Missouri.......... 22
  Pruning............................... 22
  Runner cutter......................... 23
  Selling price for canning purposes...... 21
  Shipping............................223-227
  Styles of pruning practiced in the Northwest............................ 103
  Value of.............................. 37
  Varieties.......................87, 224-
Strawberry as grown commercially in the west, the............................ 22
Strawberry growers' shipping associations................................ 22
Strawberry growing in Missouri.......... 22
Succotash, canning of................... 21
  Cost of canning....................... 212
Summer hotbed crops....................273-4
Summer institute........................ 4
  Program of............................24-
  Papers of.............................26-9
Summer pruning.......................... 31
Sunscald................................ 107
  Of the peach.......................... 278
Sweet potatoes, canning of.............. 211
  Cost of canning....................... 212
  Selling price for canning purposes...... 213
Tarnished plant bug..................... 22
Taylor, E. P.............70, 173, 185, 200-
Temperatures at numerous Missouri points................................125-
Temperature Agricultural Experiment Station................................ 289
Thinning fruit, relation of, to hardiness... 128
Timber, area of, in Missouri............. 157
Timber industry, Missouri's rank in the... 157
Timber, supply of, in Missouri..........275-8
Tippin, G. T..............15, 36-8, 47-8, 53
Tobacco dust, use of, cost...........189, 19
Tobacco tea............................. 323
Todd, T. H......47, 85, 131, 163, 172-4, ...214, 221, 19
Tomato, blight of....................... 31
  Rot of................................ 31
Tomatoes................................ 4
  Acreage............................... 4
  Canning of............................ 21
  Cans for.............................. 2
  Fertilizers........................... 5
  Growing the plants.................... 4
  Hotbeds............................... 5
  Prices paid by canners................ 21
  Profits............................... 4
  Soil.................................. 51
  Varieties for canning................. 211
Top working............................. 46
Treasurer, report of...................21, 22
Treating infected orchard free of charge... 193
  For one half expense.................. 194
Trees, varieties........................ 94
  Wrappers.............................. 264
Twig blight............................. 288
University of Missouri, chair of forestry in.................................... 16
"Ups and Downs" of apple growers........ 90
Varieties of apples, prices of 169
  Grapes, description of...............180-2
  Peaches, green twig types............. 130

Varieties—Continued. Page
  Peaches, hardiness of, as to............ 129
  Vines.................................. 93
Variety tests, funds for...............11, 12
Vegetables, canning of...............209-12
Vermont Agricultural Experiment Station........................290, 295
Vines.................................. 89
  Varities of.......................... 93
Violets, growing of in hotbeds.......... 275
  Leaf spot fungus..................... 291
    Losses due to...................... 285
  Varieties of......................... 291
Visiting representatives............243, 244
Watermelon, wilt disease................ 292
Wayne County Horticultural Society..... 249
Weber, H. J............................ 239
West, J. B.....................192, 196-7
White, C. 230
Whitten, J. C......36-7, 90, 93, 96, 174, ...214, 254, 296
Wheat rust...........................285-6
Whortleberries, selling prices for canning purposes.............................. 213
Why we prune.........................174-8

Page
Wild crops............................. 298
Wild grapes (see Coutant)
  As an ornamental vine................ 94
Willow rust............................ 296
Wilmeroth, C. W........................ 132
Wilson, L. C......61, 82, 85, 95, 111, 131, ...232, 234
Wilt disease of watermelon............. 292
Wilt fungus of cotton.................. 290
Winter cover crops for orchards........ 218
Winter institute....................... 97
  Program............................98-101
Wiping and sorting apples.............. 137
Wisconsin Agricultural Experiment Station.............................. 288
Wisdom of having the office of Secretary at Columbia.......................... 7
Wooly aphis................19, 188-90, 323
Work accomplished in 1908...............4-9
Yearbook U. S. Department of Agriculture................................. 288
Yellows, peach......................... 68
  Treatment............................ 68

Acc No 5986

245